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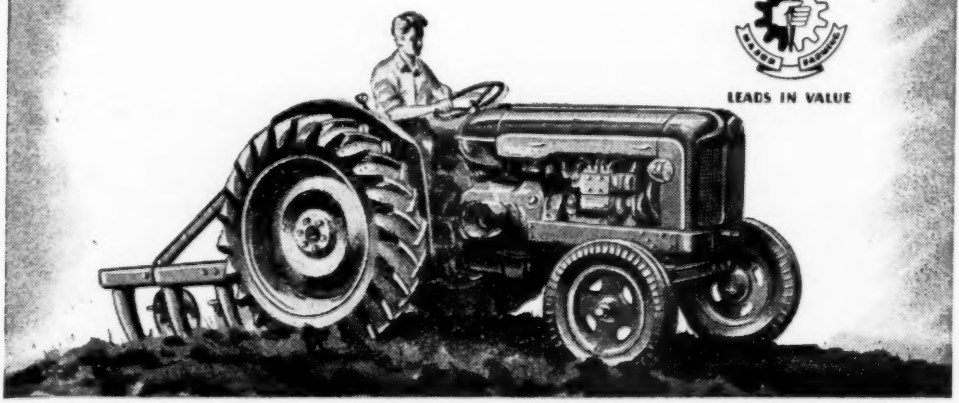

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Cover Photograph

Fifteenth century farmhouse, roofed with stone "slates", at Brewer Street, near Bletchingley, Surrey.

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New Year

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL. LX No. 10 JANUARY 1954

AGRICULTURAL POLICY AND ITS BACKGROUND

THE RT. HON. SIR THOMAS DUGDALE, T.D., M.P.
Minister of Agriculture and Fisheries

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IN the last fifteen years our agricultural productivity and food production have made phenomenal progress. Although our farming acreage is much the same as it was in 1939, food production is now 51 per cent above pre-war. Before the war our farmers and farm workers fed only one-third of our population. Today the consumer is feeding as well as he did in the late 'thirties; and we are producing close on half the food needs of a population which is nearly three millions greater. No other country in the world—except perhaps the U.S.A.—can point to a comparable agricultural achievement—an achievement which few urban industries in this country can match.

The Government's objective is to continue this advance. It hopes to see production rise a further 9 points so that it reaches 60 per cent above pre-war by 1956. To do this we must consolidate the rapid progress of recent years. We must concentrate on lowering costs and improving quality so that the housewife can get what she wants at a reasonable price.

Agriculture and Industry Although, personally, I feel strongly that a thriving agriculture is a great social asset in an industrial and trading country like ours, the main reason for this policy is economic and strategic. Britain is more vulnerable than she was before the war. Then we were the world's biggest creditor. Now we are its greatest debtor. Today, we face a world in which growing populations, higher living standards, strategic uncertainties and industrialization in many of the traditional food-exporting countries are all making our imported food supplies less certain than they were before the war. Thus the hard facts of today—and of tomorrow—dictate an agricultural policy geared to higher production at a lower cost.

This is the primary justification for the expenditure of the taxpayers' money on research and advisory services; on liming, fertilizers and other production grants; for the subsidies which are designed, directly or indirectly, to stimulate food production and enhance farming efficiency; and for the guaranteed agricultural prices and assured markets under Part I of the Agriculture Act, 1947.

This expenditure of public money and this positive policy do more than help us to safeguard our food supplies. They also help to safeguard and

promote a steady but expanding industrial market on our own doorstep. It is, for instance, estimated that each year agriculture buys about £500 million of production goods and services from other, mainly manufacturing, British industries, as well as £600 million of consumer goods and services. British farmers and farm workers are, in fact, among our manufacturers' best and steadiest customers; they are now a stabilizing factor in the national economy. This in itself is a great step forward since pre-war days. Apart from this, our agriculture provides a mass market and a springboard for some of our new and thriving export industries. In 1952, we exported £62 million of tractors and other agricultural machinery, as well as large quantities of herbicides and insecticides, agricultural drugs, seeds and fertilizers.

The striking advance in output and efficiency which I mentioned earlier have their roots in the hard work, the skill and initiative of those who live on and by the land; in the new tools which the ingenuity and research of the engineers and the scientists have given us; in the faithful and selfless voluntary services which the County Agricultural Executive Committees and their Sub-Committees and District Committees, together with many other organizations and individuals in the countryside, have devoted to the cause of food production. But this progress could hardly have begun, let alone been achieved, if the farming community had not been confident that their labours would be reasonably rewarded and that their markets would be adequately assured.

Economic Stability Farm products are perishable and have a long production cycle. Farmers tend, therefore, to be weak sellers. Further, farm management is now a more complex job. Fifteen years ago the farmer could concentrate on getting the best out of his land and his livestock and on coping with the vagaries of nature. Today he has to be an engineer, a bit of a chemist, and a businessman with a head for figures as well. He cannot devote his major energies to his complex job if his industry is plagued with economic instability. And so, if the farmer is to raise his productivity and his production he needs an adequate assurance that he will have a sure market at a reasonable price.

The emergency powers of the Ministry of Food were primarily designed to safeguard the consumer and assure him a sound diet without his having to pay unduly high prices. Under these powers, the Government became the sole buyer of most of our stable farm products. It could thus fix, for a year or more ahead, U.K. farm prices which were based on production costs and on national needs. This gave our farmers and farm workers the stability and confidence in the future that they needed to get on with the job of producing more food more efficiently.

After the war, all Parties agreed that, in the interests of producers and consumers alike, a stable peace-time agriculture was a national necessity. Hence the Agriculture Act of 1947, Part I of which provides for a system of guaranteed prices and assured markets for our main agricultural products. Now, however, that food rationing and State trading are coming to an end, the administrative methods by which farmers are to get guaranteed prices and assured markets must inevitably be adjusted to the new and freer conditions. They must also, if possible, cater on the one hand for the natural desire of the farmers to have a say in the way their products are marketed, and leave scope, in suitable cases, for producer marketing boards. On the other, they must recognize the rights of the traders, on whom the farmers depend for the distribution of their produce. Finally, they must not place too heavy a burden on the Exchequer and the taxpayer.

Marketing Developments After twelve years of control, it has not been at all easy to reconcile these often conflicting interests. But after full consultations with the leaders of the farmers and of the trades concerned, the Government believes it has evolved a constructive, fair and comprehensive marketing policy. It was recently published in a White Paper (Cmd. 8989)*.

This policy meets the needs of the present, leaves ample room for the future development of efficient marketing and also, I think, attracts the highest common degree of consent from the farmers, traders and other interests concerned. Its application will be a task of formidable dimensions. It involves several hundred thousand farmers, thousands of processors and merchants and 50 million consumers. It concerns an output valued (at the farm gate) at £1,100 million per annum. But with the continued help of the leaders of the farmers and the traders I am sure it can be made to work—and work well.

The White Paper announces that the rationing and control of meat will end next summer, and that, with a few minor exceptions, State trading in all foods will also cease then. The most important home-produced commodities affected by this decision are milk, meat and bacon.

Full marketing powers can be restored to the Milk Marketing Boards in 1954 for all milk. There must, however, be proper safeguards for the Exchequer, the consumer and other interests. For instance, so long as an element of consumer subsidy remains, the Government will have to approve the level of prices and distributive margins. On the health and welfare side the Clean Milk policy, the Milk in Schools Scheme and the Welfare Milk Scheme will continue.

Then there is the problem of meat and bacon. On the one hand, the farmers' leaders wanted a comprehensive producers' marketing board with powers to require farmers to sell to it, at fixed prices, all the fatstock they produced. On the other, the auctioneers and the meat traders wanted to regain their freedom and go back to the pre-war fatstock auction system and wholesale meat markets. But the dominant factor was time. Rationing has to end next summer and, with it, State trading in food must go. The Government had to devise a plan to meet the immediate situation—a plan which would be open to modification in the light of experience. This it has done.

The present plan recognizes the rights both of the farmers and of the meat trade. The twofold guarantee included in it satisfies the need of the farmers for price stability. It restores freedom of marketing and distribution to farmers, auctioneers, the meat traders—and perhaps most important of all, it restores freedom of choice to the consumer.

The Government's policy for guarantees of market and of price, as set out in the White Paper, covers all the commodities to which the guarantees under Part I of the 1947 Act apply, and it provides for marketing boards in all suitable cases—particularly milk, potatoes, wool and bacon pigs. It would permit a board to promote the voluntary sale of fatstock on the hook (that is, by dead weight) and does not rule out a Fatstock Board with wider functions at a later stage.

Summary To sum up. We are, as a nation, more vulnerable—economically and strategically— than we were before. To retain our independence we need an agriculture striving for higher production and better quality at lower cost. The Government's objective, therefore, is to

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help the farming community to carry still further the numerous advances in production, productivity and technical efficiency it has achieved since 1939. To do this farmers, who generally tend to be weak sellers, must have confidence that they will have markets at reasonable prices.

The present system of providing farmers with guaranteed prices and assured markets has been closely geared to consumer rationing and State trading. Now that these are to end, the farmers must have reasonable opportunities for marketing boards and the methods of guarantee must be changed. But the principles of the 1947 Act remain inviolate. The agricultural industry need therefore have no hesitation in going forward the remaining steps towards the Government's production objective, which is an output of 60 per cent above pre-war. Farmers—and those who help them with equipment, capital, fertilizers and other requisites—can face the future with sober confidence.

ACCENT ON PRODUCTIVITY

THE ROLE OF MEASUREMENT ON THE FARM

A. N. DUCKHAM, C.B.E., M.A., Dip.Agric. (Cantab.)
Ministry of Agriculture and Fisheries

Farming is a business, and, like all others, its efficiency needs to be accurately assessed. This subject is discussed below and in two other articles by C. H. Blagburn and R. N. Dixey which will be published in the February and March issues respectively.

FARMING today is a much more complex job than it was before the war. The Minister of Agriculture, Sir Thomas Dugdale, recently summed this up in his article in the *Financial Times Agricultural Supplement* (see pp. 451-4 of this issue) when he wrote: "Fifteen years ago the farmer could concentrate on getting the best out of his land and his livestock and on coping with the vagaries of nature. Today he has to be an engineer, a bit of a chemist, and a businessman with a head for figures as well."

New and expensive machinery; the need to make the best use of manpower; the greater dependence on purchases of fuel, fertilizer and feedingstuffs; the growing array of insecticides, vaccines, new varieties of corn, new seeds mixtures, and so on—all add to the volume of desk work and day-to-day decisions. Now that the self-contained farm, except in some hill districts, is largely a thing of the past, the business side of farming looms larger.

These same new developments, particularly now that feedingstuffs and marketing controls have gone or are on their way out, give most farmers more room for manoeuvre. The individual is less tied to traditional rotations; custom is no longer always an effective or profitable guide.

In brief, the technical developments of the last twenty years have made it easier to produce more food more efficiently, but they have, by the same token, made management more difficult. One of the problems of the day,

therefore, is to ease the daily strain of running a farm by trying to make management easier.

Milk recording and similar measuring techniques can, and do, make some contribution to the solution of this problem. For in farming, as in other industries and professions, good measuring techniques are very useful diagnostic tools in the running of a business. They help to reveal specific weaknesses because they make it easier to compare one period with another, or one's own results with a neighbour's or with locally accepted standards. They provide a chance to put husbandry troubles right without having to wait for the year's profit-and-loss accounts.

In addition, good measuring techniques stimulate curiosity, observation, controversy, competition and pride of craftsmanship—five effective psychological spurs in any walk of life. And they make it easier to swap knowledge and experience.

But if it is to be effectively and widely used for these several purposes, a measuring technique must meet certain conditions. It must be accurate, simple, inexpensive of time and materials, direct or, at least, easily explainable, and quick off the mark. None of the techniques now used in this country is perfect—at least by these standards—but we must not let the best defeat the good. Nor must we rule out techniques merely because they are, at present, inaccurate or complicated. For complexity and imperfections are, after all, often the parents of simplicity and reliability.

Commodity Recording Schemes So much for the need for technical measurements and their use in running a farm. Let us now look briefly at the measuring techniques being used in this country. The best-known commodity recording scheme is, of course, milk recording. But despite its popularity and obvious value, official recording of yield per cow still only embraces one-quarter of the national dairy herd. The most apparent defect of milk recording is that it does not relate the input of feed to the output of milk. In some areas attempts are being made to overcome this. Thus in Cheshire, where milk is the king-pin of farm income and grass the key crop, a scheme for recording gallons of milk sold per acre devoted to cows shows variations almost as wide as the more commonly quoted differences in herd averages. For example, on three grassland type farms the sales per acre per year were 834, 570 and 415 gallons respectively. In the arable Eastern Counties, a scheme for recording the amount of starch equivalent consumed per gallon of winter milk shows a range between the recorded farms of 4.3 to 9.3 lb., with an average of 5.9 lb. Similar schemes run from Cambridge for pigs and poultry show variations of much the same order in the food consumed per lb. of liveweight gain or per dozen eggs.

There are no recording schemes for cattle or beef production or for sheep, unless it be for the recording of lambing percentages. This lack springs, no doubt, from (1) the practical difficulties of devising simple measuring techniques for grazing or yarded stock, (2) the great variation in sheep- and beef-producing methods, and (3) the seasonal (and often unpredictable) movements of store stock, which make it impossible to trace life history or check gains over long enough periods.

Pig recording, which measures the weight and number of weaners produced per sow per year, does not present the same difficulties. A start was made with this in 1927, but it fell off during the war. It has, nevertheless, persisted in a small way in Buckinghamshire and in north-east Scotland, and is shortly to be tried out again in other counties.

Threshed crops and sale crops, such as potatoes or tomatoes, which are sold by weight, are simple to measure and hardly call for a formal scheme. The recording of grass is, by contrast, still in its infancy. It presents formidable problems which have, however, not deterred groups like the South-eastern Grass Recording Club from tackling them with a fair measure of success. From their records they estimate how much starch equivalent (which is a measure of energy) a field is assumed to have supplied—a method which gives a rough but useful estimate of the implied output of S.E. from grass for each field (or farm) for the period. Although open to criticism, this method may well be sounder and is certainly simpler than trying to measure grass output by cutting sample strips or by other devices which are not practicable on commercial farms.

Total Farm Production The measurement of total production, whether from an individual farm or from a district, is usually better expressed in terms of cash than of starch equivalent or some other scientific unit. In practice the calculation of starch equivalent output is complicated and often is not worth making to cover both crops and stock. By comparing yields on one farm or district with local or national averages or with locally accepted standards for the soil and type of farming involved, one can roughly judge cropping efficiency without going to the trouble of converting yields of crops into starch equivalent.

The complexities of the starch equivalent method can be avoided on the livestock side by checking the number of all types of stock against the total acreage they use and the bought-in feed they consume. Under a method commonly used, an 11 cwt. cow giving 350 gallons at 3.75 per cent butter fat is taken as standard and called "a cow-equivalent" or "productive animal unit". Other livestock are expressed as fractions of a productive animal unit (P.A.U.). Thus a lowland ewe is one-fifth of a unit; a laying hen one-fiftieth. The total stock on the farm is then calculated in terms of P.A.U.s. This total is then divided into the grand total of the acreage of crops and grass devoted to livestock, including purchased feedingstuffs—taking one ton as equal to one acre. The result is the number of acres required per P.A.U. Thus on good land there should be, say, one P.A.U. for every 2½ feed acres (that is, for each 2½ acres devoted to livestock). On medium hill land, one P.A.U. to 10 acres may be reasonable, and so on.

A variant of this approach is to estimate the feed acreage devoted to milk or sheep or poultry and divide it into the output. On good land it should be possible to get, say, 200 gallons of milk or 100 lb. dressed carcass weight mutton or lamb per acre. A technique of this type is the basis of the farm production recording scheme successfully operated in Hampshire since 1941 by the Central Council of Growmore Clubs. This scheme was described in Mr. D. P. Johnston's article, "Farm Production Recording in Hampshire", in *Agriculture*, 1946, **53**, 402-10.*

Overall Farming Efficiency It is generally recognized that technical efficiency has three parts: first, high output of the goods the consumer needs; second, well-balanced input of feed, fertilizer, labour, and other expenses; third, maintenance of long-term production potential (that is, good husbandry). Most of the measuring techniques described above concentrate on the first part—high output. It is not always easy to bring in the second part (input) without using economic measurements which

* Another approach is that of J. W. EVANS in his book *Land Potential* (Faber, 1951), who puts forward a scheme which expresses farm output as a percentage of a local standard based on an ecological formula.

may involve delving into accounts that a farmer may either wish to keep private or not keep in very usable form. In any case, it is not possible to reduce a mixture of inputs of labour, seed, fertilizer, etc. to a simple non-monetary figure. This latter difficulty applies, of course, with even more force to the third part (good husbandry), which cannot, as yet, be expressed either physically or in terms of cash.

The Farm Survey carried out by District Committee members of the A.E.C.s goes some way to meet these difficulties. Assessments of cropping, stocking, labour organization, and so on, are made by men who know their district well. The survey is simple, inexpensive, easily explained and generally accepted as just. What it lacks in statistical refinement it gains in advisory and administrative value. It is very useful in revealing weak points where the farmer may need help of some kind.

Conclusions This brief review suggests that the recording and measuring techniques now in use are only of limited value in measuring total farm production and overall farming efficiency. The former is usually best expressed in cash or economic terms but may sometimes be usefully augmented by physical records of measurements of yields per acre or per animal, rates of stocking and so on. The latter cannot, as yet, be readily measured either physically or in cash.

On the other hand, commodity recording, which measures the production per acre or per animal or the input of, say, concentrates per gallon of winter milk, is of proven value. It is not only of great importance in breed and crop improvement, but it is very useful in day-to-day management and is, indeed, almost essential to technical, and, hence, to economic advance.

At present, we have useful commodity recording (or measuring) techniques for milk, eggs, cereals, potatoes and sugar beet. These products account for about half the value of farmers' total sales. For fatstock, which account for nearly one-third of farmers' total sales, and for grass, roots and fodder crops consumed on farms, we lack effective or widely used measuring techniques. On the input or expenses side, we lack simple measuring techniques for the use made of labour, machinery and fuel, on which farmers spent roughly £480 million in 1952-53. There are, therefore, two main gaps in our tool-kit of measuring techniques. The first relates to grassland, forage crop and meat animals; the second is the input of, or expenditure on, work (labour, machinery and fuel).

A century and a half ago Napoleon said: "An army marches on its stomach". Today he would have added, "but it advances on its instruments —fuel gauges, speedometers, range-finders, radar, etc." And this applies equally to agriculture as well as industry and science. Our rapid progress in crop, milk and egg production is undoubtedly closely tied up with the effective use of good instruments—that is, with sound methods of measuring technical efficiency.

Hence the productivity of our grassland and of our major meat-producing animals would, all experience suggests, advance much more rapidly if we could devise simple and effective output measuring techniques, but that is not easy. We have three main needs: (1) to devise simple, inexpensive kits for determining the feeding value of grass and roughages; (2) to review our present assumptions for the starch equivalent requirements of young growing and fattening cattle and sheep; and (3), perhaps more important, to work out simple methods of weighing or estimating the live and dead weight of a bunch of cattle or sheep, if necessary using sample techniques based on "tracer" animals.

If we are to devise good techniques to meet those needs, we probably ought to approach these essentially practical problems with the same degree of curiosity and ingenuity that a scientist approaches a measuring problem in the laboratory. On the one hand, we might seek help from some of the new measuring tools (such as radar, echo-sounding, radiography and radio isotopes) which the physicist has given us and which are now being used increasingly in industry. On the other, we might have another look at some old-fashioned methods. For instance, the preliminary results of a current investigation at the Rowett Institute suggest that the correlation between live weight and girth and other body measurements may be more accurate and useful than some of us think.

On the input or expenses side, and particularly on labour, machinery and fuel, there seems to be great scope for effective measuring techniques and standards. The usage of fertilizer per acre is often a useful indicator of the overall efficiency of a farm. Some of the bigger milk producers expect 15–20,000 gallons of milk per man per year, and look for weaknesses in labour organization if they do not achieve that figure. Could we not extend the range and devise useful techniques for other inputs, particularly for tractor time, which probably costs a good deal more on many farms than we are inclined to think? If, for example, one tractor-hour (including labour, fuel, interest and depreciation) roughly equals in cost 3 or 4 hours of the tractor driver's time, then we might be able to work out a useful measure of "work" input per ton of product or per £100 gross output.

In other words, the application to our new, highly mechanized farming of some of the measuring techniques currently used in industry might usefully help us to raise productivity—particularly output per man. After all, productivity depends as much on the way in which we use each of the ingredients of farming (land, livestock, feed, fertilizers, machinery and labour) as it does on the general production policy or the business management of a farm.

SILAGE FOR WINTER FEEDING

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For the past five years the Seale-Hayne College Farm has achieved a high degree of self-sufficiency in feedingstuffs for cattle and sheep, and during the whole of this time silage has been the mainstay of the winter feeding programme.

THE Seale-Hayne College Farm covers some 314 acres, of which 200 are leys and permanent grass and 114 are given over to arable crops. The dairy herd consists of 28 South Devon cows and heifers in milk, 14 Guernseys in milk, and 75-80 followers of both breeds. In addition, there is a flock of 80 South Devon and 40 Scotch half-bred ewes and a herd of 25-30 Large White sows. Thus milk, beef, lamb and bacon pigs are the chief livestock products. So far as feeding is concerned, the policy during the past five years has been to attain a high level of self-sufficiency for cattle

and sheep and to provide approximately one-third of the foods required by the pigs. The arable land supplies oats and barley, fodder beet, arable silage, beans, and, in some years, kale and cabbage, while the grassland provides hay, silage and dried grass.

In no single year have we made the quantity of silage planned, due to the difficulty of cutting and ensiling it fast enough during the "flush". As a result more hay has been made every year than was intended. By introducing more labour-saving equipment in the coming year it is hoped to increase the quantity of silage and restrict the hay to that which can be made on tripods.

The silage accommodation available at the present time is:

Type of Container	Capacity	No.	Total Capacity
	tons		*tons*
Concrete-lined pit	70	2	140
Towers (roofed)	20	2	40
Small experimental towers	10	2	20
Concrete clamp	100	1	100
Sectional surface silo	45	1	45
			345

Experience clearly indicates the vital need for all silos to be adequately roofed to keep out rain, both during making and through the winter. Waste-free silage is produced in the roofed tower silos; the pits and clamps are in the process of being roofed.

Table 1 gives details of the general level of self-sufficiency attained in an average year (1952-53).

Table 1

Foods Fed during 1952-53 (Excluding Grazing)

Stock Group	* Hay	* Grass Silage	* Arable Silage	* Fodder Beet	* Beet Tops	Potatoes	* Rape	* Cabbage
	tons	*tons*	*tons*	*tons*	*tons*	*tons*	*tons*	*tons*
Cattle ..	79	164	70	—	—	—	48	—
Sheep ..	4	19	—	—	24	—	16	—
Pigs ..	—	—	—	90	—	36¾	—	15
Horse ..	2	—	—	—	—	—	—	—
**Total .. ..

One-sixth of Nutrients from Silage To show more clearly the percentage of the total food fed that was home-grown, the starch equivalent and protein equivalent supplied by each food have been calculated from data given in the Ministry of Agriculture's Bulletin No. 48, *Rations for Livestock*, and from analyses of silage and hay obtained at the College. The results show that over the whole year (not including the contribution of grazing) home-grown foods provided 62 per cent of the total starch equivalent and 43 per cent of the total protein equivalent fed to all stock. Taking each group of stock separately, home-grown foods provided: (*a*) 82 per cent of the starch equivalent and 72 per cent of the protein equivalent fed to cattle; (*b*) 88 per cent of the starch equivalent and 77 per cent of the protein equivalent fed to sheep; (*c*) 40 per cent of the starch equivalent and 17 per cent of the protein equivalent fed to pigs.

In addition, it has been calculated that grass and arable silage provided 16 per cent of the starch equivalent and approximately 15 per cent of the protein equivalent of *all* foods fed, and 26 per cent of the starch equivalent and 34 per cent of the protein equivalent of all the *home-grown* foods fed. In other words, in this particular year silage provided approximately one-sixth of all nutrients other than grazing and one-quarter of the nutrients in the home-grown foods.

Breaking down the data concerning silage (grass and arable) still further, the main conclusion is that it supplied approximately one-third of the energy and protein requirements of the cattle and one-quarter of that of the sheep. In respect of home-grown foods only, silage supplied 38 per cent of the starch equivalent and 45 per cent of the protein equivalent fed to cattle, and 28 per cent of the starch equivalent and 32 per cent of the protein equivalent fed to sheep.

Rations for Cattle and Sheep During the course of the year the Guernseys ranged in yield from 750 to 1,000 gallons, and the South Devons from 650 to 1,000 gallons. Typical rations fed are given in Table 2, the South Devon cattle receiving up to a maximum of 80 lb. grass silage per day and the Guernseys a maximum of 60 lb. per day. The silage is always fed after milking and care is taken to remove any uneaten silage and keep the troughs clean.

Table 2

Typical Daily Dairy Cow Rations for 3 gallon Yield (Winter 1952-3)

	South Devons		Guernseys	
	a	or *b*	*a*	or *b*
	lb.	*lb.*	*lb.*	*lb.*
Hay	10	10	7	7
Dried beet pulp	4½	—	4½	—
Grass silage	60	80	50	55
Dried grass	5–6	5–6	3	6
Concentrate mixture ..	—	—	4½	4½

Space does not permit of more than a brief mention of other uses of silage with the cattle on the Farm, but a few typical rations may be quoted. With the South Devon steers a ration that is proving satisfactory for the fattening

of beasts between 11 and 13 cwt. is:

	lb.
Hay	7
Silage	80–90
Cereal mixture	4

For young cattle overwintering in yards, aged approximately 1¼ years and weighing on average 700–800 lb., the following ration has been very successful:

	lb.
Hay	7
Fodder beet	20–25
Oat and tare silage	25
Concentrate mixture	2 (50 per cent home-grown)

Three years ago we began to feed grass silage to pregnant ewes during the last 4–6 weeks of their pregnancy and in the early part of their lactation. Lambing usually starts in late January, so the silage is introduced in the second or third week of December. Grass silage with 15–17 per cent of crude protein in the dry matter is carted out daily and put in covered racks. Prior to feeding silage, the ewes live entirely by grazing and they normally take quite readily to the new feed. The weight of silage fed is recorded periodically and the South Devon ewes, for instance, start eating about 5 lb. per day and increase, over a period of approximately two weeks, to a maximum of 8 or 12 lb. per head per day. Racks are generally cleared within 24 hours: if they are not, the uneaten silage is removed before refilling.

The ewes also receive some concentrate mixture with a starch equivalent: protein equivalent ratio of 4½ or 5 to 1. Feeding of concentrates starts about the same time as the silage and the amount does not exceed ¾ lb. per head per day.

The ewe flock gives little trouble and appears from a study of the live-weight gains of the lambs to milk well, as the following table indicates:

Table 3
Weight of Single-reared Lambs as a Percentage of the Weight of Twin-reared Lambs (South Devon Flock 1952-53)

Age	1952	1953	Average Weight of Singles 1952	1953
days	*per cent*	*per cent*	*lb.*	*lb.*
21	130	124	27.5	27.74
42	137	114	42.52	41.29
63	129	120	52.12	51.21

Potato Silage for Pigs During the past three years, the general practice has been to feed the fattening pigs on the Lehmann system, using fodder beet from October until May and potato silage from May until October, plus 3 lb. per day of basic meal with beet and 2½ lb. per day with potatoes. From time to time, freshly boiled potatoes are used instead of silage, since the potato silage accommodation is only 22-25 tons.

The potatoes are cooked, using a coke boiler with two containers – one holding 4 cwt. and the other 3 cwt. of potatoes. One man does the work of steaming and ensiling among other jobs. The total cost of ensiling is rather high, being approximately £1 per ton. Hence, care is taken to buy in stockfeed potatoes at those times in the winter when prices are low.

Table 4
Grading of Bacon Pigs from College Herd

Grade	1951–52		1952–53	
	All Year	Summer 22 weeks	All Year	Summer 22 weeks
A	169	66	163	55
Others	13	5	8	6
Total	**182**	**71**	**175**	**61**

Potato silage is used in the summer 22 weeks.

No trouble has been experienced in feeding potato silage either to baconers or to breeding pigs. The latter receive up to 10 lb. a day. The meal fed in conjunction with the bulk food is, of course, higher in protein than the normal feeder's or breeder's meal and is reinforced with the necessary minerals.

Over a period of three years, grading results have been very satisfactory, as shown by Table 4 above.

It is not at all clear at the present time whether it will be an economic proposition to feed potato silage in the summer of 1954. If the prices of meal keep on falling whilst the price of stockfeed potatoes remains at, say, £5-6 per ton, without the cost of ensiling being considered, then it is doubtful whether it would be worth while feeding them.

Under the conditions ruling on the College Farm – high rainfall, land of difficult contour and a heavy soil – reliance on silage as the mainstay of the winter feeding of cattle and sheep has been more than justified. Experience has shown that care is necessary in making the silage if a product of high feeding value and free from waste is to be secured. But the rules of silage-making are simple and easy to follow. To secure silage at a low cost per ton demands thoughtful mechanization (this is not necessarily expensive) and a carefully worked-out field technique, but once these details are mastered, how very rewarding are the results and how very encouraging they are for the future of silage-making!

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THE MANURING OF FRUIT

1. YOUNG TREES

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This article is the first of three on fruit manuring problems based largely on experience in south-eastern England. The dressings of fertilizers* recommended may not be suitable for other areas, especially as regards nitrogen. The second and third articles, dealing with mature trees and soft fruit respectively, will be published in the February and March issues.

TREE fruits are planted under such a wide range of conditions that it is difficult to summarize all the possible manurial points which arise in practice. First the potash status of the soil has to be considered, and there are few soils, at any rate in the south-east of England, where potash does not require building up where fruit trees are to be planted for the first time. Between 3 and 4 cwt. muriate of potash per acre broadcast and cultivated in is a suitable dressing prior to planting, but if reserves of available potash are particularly low, it might be advisable to plough in 1–2 cwt. muriate of potash per acre and follow this with a dressing of 2–3 cwt. per acre after ploughing.

Lime, Magnesium and Phosphates Tree fruits are generally resistant to acid soil conditions; in fact, a slightly acid soil is desirable for these crops, and there does not appear to be any obvious foundation for the old belief that "stone" fruits require large quantities of lime. On the other hand, on strongly acid soils young apple trees can suffer from an eruptive condition of the lenticels commonly known as "measles" or "pimples", often accompanied by a considerable amount of die-back, and even resulting in the death of the tree. Such problems are not infrequently met, and in one case on a strongly acid soil investigated by J. O. Jones and the writer, affected trees responded well to dressings of alkaline materials, notably basic slag. Acidity is not, of course, the only cause of "measles" – a point which will be dealt with more fully later.

Another factor to be taken into consideration on acid land is that many plantations are eventually grassed down with seeds mixtures containing clovers, and as the latter are intolerant of strongly acid soil conditions, lime should be applied at two-thirds of the full recommended lime requirement in all cases where the *p*H value of the soil is below 5.8. Where dessert apples, such as Cox's Orange Pippin, Laxton's Superb and other varieties susceptible to magnesium deficiency are to be planted, lime should preferably be applied in the form of high-grade ground magnesian limestone, which supplies magnesium as well as correcting the acidity. For the other fruit crops, finely ground chalk or limestone is generally satisfactory, except on soils which are markedly deficient in available magnesium. Where the lime requirement is high, half the dressing may be ploughed in and half worked into the surface soil after ploughing. It should be remembered,

* Dressings of inorganic nitrogenous fertilizers are given in terms of sulphate of ammonia, but on acid soils "Nitro-Chalk" may be substituted with advantage at slightly heavier rates. Unless otherwise stated, dressings of phosphatic and potassic fertilizers and materials containing magnesium are given during the winter, while nitrogenous fertilizers are applied in February and early March. Organic nitrogeneous fertilizers and manures – for example, meat-and-bone and shoddy – should be applied a little earlier.

however, that magnesian limestone is produced in areas which are usually remote from the fruit-growing districts, so that heavy transport costs have to be borne.

If dessert apples are to be planted on land which is not acid (that is, where magnesian limestone cannot be used), magnesium sulphate should be given at the rate of 2-3 cwt. per acre. The most usual practice among fruit growers is to wait for magnesium deficiency to appear before taking remedial measures, but there is much to be said, particularly on the lighter soils, for building up magnesium and potassium concurrently from the beginning of a new plantation.

Fruit trees, when once established, appear to show little demand for phosphate, but dressings of phosphatic fertilizers in the early years may encourage root development in the young trees. If the soil is deficient in available phosphate, therefore, 4 cwt. superphosphate per acre should be worked in before planting.

Despite frequent advice to the contrary, no organic material or soluble fertilizer should be placed in the planting hole; the former may produce a dry zone under the tree roots in the summer after planting, while the latter can cause direct damage to the roots. Fertilizer injury to the tree roots (or what is physiologically the same thing, drought) is also a common cause of "measles" in young trees. Newly planted trees may also be injured by fertilizers when excessive dressings are applied to the surface of the soil around the tree itself. A simple calculation will show that if 4 cwt. of fertilizer are applied to an area of about one square yard around each tree (say, at 200 trees per acre) then the *effective* rate of application is not 4 cwt. but several tons per acre. When fertilizers are to be used around trees, they should be given at a rate which is appropriate for the actual area manured. In this connection, it is helpful to remember that 2 oz. per square yard is roughly equivalent to 5 cwt. per acre.

Although not strictly a manurial question, it may also be noted in passing that excessive treading of the soil at planting time may be harmful, particularly on heavy soils, by causing waterlogging around the tree roots during the winter. The final firming of the soil should be delayed until the mulch is applied in early spring, when the soil is beginning to dry out. On the other hand, it is essential that the tree should not "rock" in the soil. If necessary the tree should be staked at once.

Mulching It is hardly possible to over-emphasize the value of mulching in the first year or two after planting. By this means, trees can often be induced to grow away strongly from the start, whereas without mulching trees may remain stunted for a season or more, particularly if planting is followed by a dry summer. Mulches should be applied in the early spring after planting, but a few inches around the base of the tree itself should be left unmulched. If the mulch is piled up the stem of the tree it can form a harmful wet zone around the collar. The most suitable mulch is probably strawy farmyard manure, because of its moisture-retaining properties and plant food content, but plain straw, compost, grass mowings, etc., may also be used.

For a number of reasons (as, for example, the liability of the soil to produce "canker" or be subject to erosion), trees are sometimes planted in grass, although such trees usually grow more slowly than those planted in cultivated ground, because of competition between the grass and the tree for moisture

and nutrients. When trees are planted under grass, therefore, mulching is particularly important.

It is not usually necessary to give nitrogenous fertilizers to fruit trees in the early years, as, if soil conditions are satisfactory, they should grow sufficiently strongly without it. Dressings of nitrogen may also cause excessive growth and possibly increase the risk of canker. If it proves necessary to give a little nitrogen to hasten growth, then a light dressing of sulphate of ammonia may be applied—say, ¼-½ lb. applied to an area of approximately 4 square yards around each tree.

If the soil is deficient in potash, then annual applications of muriate of potash should be continued at the rate of 2-3 cwt. per acre for the first few years after planting, plus, in the case of dessert apples (or on soils especially deficient in magnesium in the case of the other fruit crops), 2 cwt. magnesium sulphate per acre. Dressings of fertilizers containing potash and magnesium should be broadcast all over the ground, whereas nitrogenous fertilizers, if given at all, should be applied to an area a little larger than the spread of the branches, bearing in mind the dangers of over-concentrating fertilizers around the tree itself.

Grass Orchards and Nitrogen It is now common practice to sow plantations to grass and clover mixtures, often between the fourth and eighth years after planting. Although the clovers can make a valuable contribution to the nitrogen requirements of the tree, it is generally true to say that heavier dressings of nitrogen are required in grassed than in cultivated orchards. This is particularly necessary in the first season or two after grassing down, and a substantially heavier than normal application of nitrogen should be given in these years, say, 4 cwt. sulphate of ammonia per acre, or its equivalent if the plantation has not previously received any nitrogenous fertilizer. If this is not carried out, the trees may receive a severe check from which they recover only slowly. Even when grass is sown deliberately to check growth, it is desirable to give some nitrogen.

Fruits, such as plums and pears, which have been traditionally grown under cultivated conditions because of their high requirement for nitrogen, can, nevertheless, be grown successfully in well-managed grass, provided that the soil is not too dry and that adequate nitrogen is given. There are, however, a few fruits (for example, the Early Victoria apple) which can perhaps be grown more easily in arable than under grass conditions.

Intercropping with vegetable, soft fruit or arable crops is frequently practised when the trees are young, and here, of course, the manuring for such crops has to be considered. Care should be taken not to over-stimulate the young trees by means of fertilizers or farmyard manure applied to the intercrop.

Next month : Mature Trees

LATE STORAGE OF POTATOES IN ENGLAND AND WALES

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Experiments on the indoor storage of potatoes have been in progress at the Ditton Laboratory since 1946*. Recent work has been directed mainly to examining the efficacy, practicability and cost of various methods of preventing the losses which occur in potatoes kept in store after March.

UNDER normal conditions the average daily consumption of potatoes in England and Wales is about half-a-pound per person, rising to perhaps half as much again in times of war, when other foods are scarce, or during periods of slump, when cheap foods are sought after. This means that with the present food habits of the country, some 300,000 tons of potatoes per month must normally be provided for human consumption in England and Wales. The potato is the most impermanent of the staple food crops but, even so, healthy tubers can be stored cheaply and reasonably efficiently until March. Thereafter, wastage and loss of quality become increasingly serious, and, since home-produced new season potatoes are not available in large quantities until July, there is a gap of 3-4 months during which storage becomes increasingly inefficient. One solution of the problem might be to dispose of the home-produced crop by March and then depend upon imported potatoes. Another way, which is adopted in practice, is to accept losses of both quantity and quality and continue to depend for the main part of our supplies upon late-stored, home-produced tubers.

Most of the wastage which occurs in healthy late-stored potatoes may be ascribed to sprouting. If we assume that some 1½ million tons of potatoes are stored in this country for human consumption during March–July inclusive it is probable that about 40,000 tons are lost in the form of sprouts alone, and there will be a further loss of weight due to the increased rate of water loss following sprouting. The loss of weight is accompanied by loss of quality, since the potatoes become wilted.

Economics of Late Storage There is no doubt whatever that the wastage of potatoes by sprouting could be prevented by suitable storage. But there is strong doubt whether the saving would be economically worth while. Before discussing methods of storage, therefore, let us calculate what the saving may be. The precise figure will, of course, vary from year to year with the price of potatoes. In March 1953, the price was £12 2s. 6d. per ton for "white" potatoes, rising to £13 5s. in April, £14 in May, £14 5s. in the first half of June, £15 2s. 6d. in the second half of June and the beginning of July, and, thereafter, £15 10s. Let us suppose a farmer had 100 tons of healthy, saleable potatoes and stored them indoors, mainly because of the greater ease of grading in the spring. If they were a variety which did not sprout very readily, and provided he did not store them to a great height (say, no more than 6–7 feet), the farmer may have kept them until March, with no great loss, in any disused farm building or in a cheap structure specially built for the purpose. Very little would be needed other than a rainproof roof and a hard, level floor. Insulation could be provided by straw bales lining the walls. Judging from our results on weight loss, and

*An account of earlier experiments on heat production and ventilation of potatoes bulk stored in farm buildings was published in the September 1952 issue of this JOURNAL.

taking the above prices, the farmer may have had about 96 tons left in March, and these he could sell for £1,164. The cost of grading would be about £24 and he would be left with £1,140.

Now suppose that the farmer, instead of selling his potatoes in March, kept them until the first week of June. He would probably then have only about 86 tons, which he would be able to sell for £1,247. Grading would be slower, because of the growth of sprouts, and might cost about £43. The farmer would thus be left with £1,204, or £64 more than if he had sold the potatoes in March. If, however, he had been able to prevent the sprouting of his potatoes by some means, he might have had some 92 tons at the beginning of June, which he would have been able to sell for £1,334. Grading would cost about £23, and he would be left with £1,311; that is, £107 more than if he had not prevented sprouting.

Leaving aside the value to the country of any means of conserving food, the maximum possible value to a farmer of a method of preventing sprouting until the beginning of June would be, at 1953 prices, about £1 per year for every ton of ware stored. This £1 must cover the interest on capital, depreciation, and the running costs of the method (cost of applying dusts or refrigerating, etc.). Many more factors, such as interest on an extended bank overdraft or the possibility of a more profitable use of manpower, influence the question of whether it is worth while to the individual farmer to store his potatoes late rather than sell them as soon as possible.

Insulation for Cool Storage Two methods of preventing or reducing sprout growth are in common use here and abroad. Either the potatoes are stored at 40–42°F., which practically inhibits sprout growth for the 3–4 months in which we are interested, or growth is suppressed by chemical means.

Taking the cool storage method first, there are two ways of achieving a storage temperature of 40–42°F.: (1) by ventilation when the air temperature falls below this level and by closing the store when the air is warmer; or, (2) by the use of mild refrigeration. In both cases it is necessary to insulate the building sufficiently to prevent excessive leakage of heat into it during warm periods. Naturally, the greater the degree of insulation required, the greater is its cost. There is, of course, a lower limit below which it is not safe to go because of the danger of contact freezing of potatoes against the wall during cold weather, but even this lower limit may be the subject of a compromise. To be safe from any danger of contact freezing, even in the coldest weather (as in spring 1947*), it would be necessary to provide insulation which permitted the leakage of only about 0.1 B.Th.U. per sq. foot per °F. temperature difference. Potato stores insulated to this extent, or approaching it, are built on the Continent and in the U.S.A., but in England and Wales temperatures sufficiently low to necessitate such a high degree of insulation are most unusual, and in most years half this amount of insulation, or even less, would be quite satisfactory. Table 1 gives a list of typical building materials with their insulating properties when dry.

Judging from the temperature of potatoes in a corrugated iron store lined with a single layer of straw bales, such a structure is insulated to roughly the same extent as one of 9-inch brickwork lined with $\frac{7}{8}$-inch boarding spaced

*Towards the end of January 1947 there was a period of seven days at East Malling during which the maximum temperature did not rise above 32°F. and the minimum temperature fell to 0°F. During February there was a period of thirteen days when the maximum temperature did not rise above 31°F.

1 inch from it. In most years in England and Wales, 9-inch brick, 10-inch concrete, or 12-inch stone, all lined with boarding as indicated above, or corrugated iron lined with straw bales, would give adequate protection against contact freezing. In the occasional very cold year this amount of insulation would be insufficient, but most growers who store in buildings accept this risk. In any case, although the freezing point of potatoes normally lies between 28° and 30°F., undisturbed tubers may be cooled much below their freezing point for a short time without actually freezing.

Table 1

Insulating Properties of Building Materials

Material	Approx. Heat Leakage (assuming 5 m.p.h. wind outside) expressed in B.Th.U. per sq. foot per °F. Temperature Difference	
	Material alone	Wall lined with ¾-inch boarding spaced 1 inch from it
9-inch brick	0.47	0.24
10-inch concrete	0.42	0.23
12-inch stone	0.51	0.25
12-inch hollow concrete blocks	0.07	0.06
10-inch cellular concrete .. (30 lb. per cu. ft.)	0.07	0.06
10-inch cellular concrete .. (50 lb. per cu. ft.)	0.14	0.11

Ventilation with Cool Air The success of a method of keeping potatoes cool by ventilating them with cool air (that is, mainly during the night) obviously depends upon there being sufficiently long and frequent periods of low temperature. If the potatoes were at a temperature of 40°F., we could expect that ventilation for 8 hours with air at 34°F. (that is, 6° cooler than the potatoes) would be as efficient as ventilation for 24 hours with air at 38°F. (2° cooler) or for 48 hours with air at 39°F. (1° cooler). If the air were at a temperature of 39°F. for two days, we could say that the accumulated temperature below 40°F. was 2 day-degrees. Similarly, if the temperature were 6° below 40°F. for one-third of a day, the accumulated temperature below 40° would again be 2 day-degrees. The number of accumulated day-degrees below 40° thus gives a direct measure of the amount of heat that could be removed by ventilation at any given rate from potatoes at a temperature of 40°F. This statement needs qualifying of course. For instance, we could not make use of air below 30°F. for fear of freezing the potatoes, so that a measure of the air available for use is really the number of accumulated day-degrees between 30° and 40°F. In actual fact, the figures most readily available in this country are the accumulated day-degrees below 42°F., and so for convenience we have used these figures in the calculations below.

Assuming that the transfer of heat from the potatoes to the ventilating air is 100 per cent efficient, it can be calculated that ventilation* with air 1°F. cooler than the potatoes at a rate of 1,000 c.f.m. for 24 hours will remove 27,700 B.Th.U. Thus if the accumulated temperature below 42°F. were

*Warming of the ventilating air by the fan and its motor is disregarded in these calculations. It may be avoided by sucking the air through the potatoes instead of blowing. The fact that the efficiency of heat transfer decreases as the velocity increases has also been disregarded.

1 day-degree in any given month, and again assuming heat transfer to be 100 per cent efficient, then ventilation at a rate of 1,000 c.f.m. whenever the air was below 42°F. during that month would remove a total of 27,700 B.Th.U. from a commodity held at 42°F.; if the figure were 100 day-degrees, the total heat removed would be 2,770,000 B.Th.U.; and so on. If now we consider the weather at East Malling during the potato storage season, we can make the calculations given in Table 2. The metabolic heat production of the potatoes has been taken to be 40 B.Th.U. per ton per hour, a reasonable average figure. The insulation of the store has been taken to be the minimum amount necessary to prevent contact freezing against the walls.

Table 2

Month	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*
Metabolic heat produced per 100 tons (1,000 B.Th.U.)	3,000	3,000	2,700	3,000	2,900	3,000	2,900
Average accumulated temperature above 42°F. (day-degrees)	64.6	52.1	53.9	113	208	345	507
Average accumulated temperature below 42°F. (day-degrees)	133	174	142	95.4	34.0	17.3	1.8
Net heat leakage into store when air is above 42°F. (rough estimate* per 100 tons storage space assuming minimal insulation) (1,000 B.Th.U.)†	–1,500	–2,800	–2,000	400	4,000	7,000	12,000
Heat removed by ventilating whenever the air is below 42°F. at rate of 1,000 c.f.m. (1,000 B.Th.U.) ..	3,700	4,800	3,900	2,600	940	480	50
Rate of ventilation necessary to remove metabolic heat alone (c.f.m. per 100 tons)	810	630	690	1,150	3,100	6,300	58,000
Approximate rate of ventilation necessary to remove metabolic heat plus heat leakage into store (c.f.m. per 100 tons)	410	40	180	1,300	7,400	21,000	300,000

*This estimate allows for heat loss caused by draughts, etc., assuming the store to be a substantial brick building.

†The minus quantities represent net leakage *out of* the store during cold weather.

c.f.m. = cubic feet per minute.

The facts that emerge from Table 2 are these:

1. Using the largest fan installation that would possibly be regarded as feasible, it would be impossible on the average to do more by the middle of May than remove the metabolic heat alone. That is, even if the building were perfectly insulated the temperature of the potatoes could only be kept down to rather above 42°F. until the middle of May.
2. With any normal amount of insulation on the building it would be feasible, on the average, to keep the potatoes at rather above 42°F. until the middle of April.

Although the above calculations refer only to East Malling, conditions are not much more favourable for potato storage at Thetford, which is the coldest place in England and Wales in the spring for which accumulated temperature records are available.

Here the average accumulated temperatures below 42°F. in day-degrees are:

Dec.	Jan.	Feb.	Mar.	April	May	June
172	214	173	130	60.1	32.2	6.9

It is clearly impossible to maintain potatoes by night ventilation at a temperature at which they will not sprout. It is possible to keep them cooler than they would otherwise be, and the greater the insulation (and therefore the less the heat leakage into the building), the lower will be the temperature at which they can be maintained. In our opinion, however, the slightly better storage which would result from an increase in the amount of insulation above the desirable minimum would not be worth the expense involved. In addition, there is some evidence that ventilation, apart from its effect in reducing temperature, may actually stimulate sprouting, perhaps by blowing away growth-inhibiting volatile substances normally given off by stored potatoes. Thus vigorous ventilation may be a bad thing, unless by using it the potato temperature may be kept down to about 40°F.—which probably cannot be achieved, on the average, later than about the middle of March in England and Wales.

Refrigeration Ventilation with outside air when the weather is cold may be supplemented by ventilation with artificially-cooled air when the weather is warm. By this means, if the refrigerating plant has the capacity to remove all the heat which leaks into the store as well as the metabolic heat, potatoes may be kept cool indefinitely. In addition, by suitably arranging the duct work, it is possible to protect the potatoes against frost damage in very cold weather by supplying warm air from the refrigerating plant condenser to the store. Such a refrigerating-cum-warming system was tested on a bulk of about 80 tons of potatoes (variety Majestic) at the Ditton Laboratory in 1952–53. Refrigeration was supplied by a 7½ h.p. unit fitted with a water-air cooled condenser. Ventilation was by means of a 36-inch axial flow air-screw type of fan powered by a 3 h.p. D.C. motor fitted for variable speed and reverse. The normal speed of the fan (1,400 r.p.m.) gave a rate of air circulation of 3,500 c.f.m. (equivalent to 4,400 c.f.m. per 100 tons of potatoes). The finned pipe air-cooling unit was installed in a length of duct work between the fan and the ducts beneath the potatoes. Its overall heat transfer coefficient, when air was circulated at 3,500 c.f.m., was approximately 1,000 B.Th.U. per hour per °F. temperature difference between coolant and air. If operated for 16 hours per day, this plant had sufficient capacity to maintain the average potato temperature at about 41–42°F., with a mean ambient temperature of 60°F. The store was of 9-inch brick lined with ⅝-inch wall board spaced ¾-inch from the walls.

Unloading began on April 20, 1953. Prior to this the potatoes had been kept at an average temperature of 41.3°F., and with a difference between maximum and minimum temperatures in the mass, where air circulation was efficient, of less than 1.5°F. The mean outside air temperature when the refrigerating plant was in use was 47°F. The refrigeration had the effect of keeping the amount of sprout growth down to the low figure of 0.5 per cent by weight of the potatoes where the air circulation had been adequate, compared with a figure of 5 per cent at the back of the store. The potatoes here had been harvested in wet weather and loaded with a lot of soil, with the result that air circulation was poor at this point and the temperature of the potatoes was higher.

r.p.m. = revolutions per minute.

The refrigerating plant was in operation for a total of 640 hours (600 cooling, 40 warming*) and used approximately 5,120 units of electricity. That is, apart from depreciation and interest on the capital cost of the refrigerating plant, the running cost until April 20 was the price of about 64 units of electricity per ton stored. If full use were made of the capacity of the refrigerating plant, the capital cost would be about £5 (say 10s. per year) per ton stored.

Chemical Sprout Suppression The high cost of cool storing a cheap crop like potatoes has been one reason for widespread investigations into the chemical suppression of sprout growth. The method commonly used is to dust the tubers before storage with a solid sprout inhibitor mixed with an inert filler. Such inhibitors include methylnaphthylacetate, tetrachlornitrobenzene and iso-propylphenylcarbamate. These substances are to some degree volatile, and volatility, even to a limited extent, means that they are slowly lost during the storage season. This may mean that, in potatoes stored until late in the season, the sprout depressant may have been largely dissipated by the time it is most needed. Nevertheless, many growers have used such dusts with considerable success.

Another method is to spray the crop some 4–7 weeks before harvest with a solution of maleic hydrazide. Spraying with an 0.25 per cent solution of maleic hydrazide in this way has been claimed by American workers to give very good results in suppressing the sprouting of tubers stored for seven months at temperatures up to 55°F.

Still another form of chemical sprout suppression is to introduce a growth-inhibiting vapour, such as an alcohol vapour, into the storage atmosphere when required. An advantage of such a method is that treatment may be delayed until signs of sprouting are seen.

If potatoes are ventilated continuously with a stream of air to which 1 mg./litre (equivalent to 1 pint/16,000 cu. ft.) of amyl alcohol has been added, they do not sprout at all. Suppression of sprout growth is less complete at lower concentrations, but is still very marked at 0.2 mg./litre. *Iso*-amyl alcohol, active amyl alcohol, and tertiary amyl alcohol behave similarly to normal amyl alcohol. The easiest way of maintaining the necessary concentration of alcohol vapour round the potatoes in an ordinary farm store is to introduce the vapour in an air stream blown through the potatoes from below, although this inevitably results in much of the alcohol blowing to waste. To reduce this waste, as low a rate of ventilation as is practicable must be used. Also, since laboratory experiments have shown that suppression of sprouting may be expected to last for two or three weeks after the treatment ends, the vapour can be applied intermittently, ventilation for at least ten days being followed by a similar period without treatment.

Experiment with Amyl Alcohol Vapour at Ditton Laboratory A description of the use of the method on a small scale at the Ditton Laboratory in 1951–52 may be of interest. About 16 tons of potatoes of the variety Majestic were stored to a height of 6 feet on a slatted false floor in a straw bale enclosure in a corrugated iron shed. Air was delivered under the floor at a rate of 40 c.f.m. by a 6-inch axial-flow-type electric fan, and alcohol vapour was introduced into the air stream when required by suspending at the delivery end of the fan thirty-four ¾-inch-wide flat cotton wicks exposed 9 inches above the rim of a container of alcohol

*It was possible to introduce heat into the store at a rate of 76,500 B.Th.U. per hour.

into which their lower ends dipped. Commercial amyl alcohol was used, as it was readily available.

In an ordinary farm building the temperature might be expected to fluctuate quite considerably, with corresponding variations in the vapour pressure of the alcohol, and the wicks had therefore to be of a number and size such that the concentration of vapour was sufficient, but not excessive, over the range of temperature which was likely to be encountered. In practice with the apparatus described, and with a mean ventilating air temperature varying during the periods of treatment from 36.3° to 59.5°F., the concentration of amyl alcohol vapour varied between 0.28 and 0.83 mg./litre. This was calculated from the weight of alcohol used and the measured volume of ventilating air. A similar weight of potatoes from the same field, stored in another building but at about the same temperature, was used as a control.

The control potatoes were unloaded and graded between May 20 and 23, 1952, and the treated tubers between May 26 and 29. The amount of sprout growth on the control potatoes varied from about 3.5 per cent by weight in the centre of the bin to nearly 9 per cent at the top. The amount of sprout growth on the treated potatoes varied from nothing at all in the centre to 2.2 per cent at the top, except for the back corners of the bin where a small quantity of tubers were sprouted to the extent of nearly 5 per cent by weight. The average weight of sprouts in the whole bins was 5 per cent in the control and 0.5 per cent in the treated.

The cost of the treatment, as applied on the 16-ton scale, could not be reduced below about £1 per ton. Further work on this method of sprout suppression is being directed to improving the method of introduction, so that a greater tonnage may be treated without greatly increasing the expenditure of the inhibiting substance, and to an attempt to find other suitable sprout-suppressing vapours. An objection to the use of amyl alcohol is that it introduces a temporary taint, although this disappears about a fortnight after the treatment ends. On the other hand, amyl alcohol possesses the advantage that apparently normal sprouting occurs some two or three weeks after the end of treatment, and the method may thus be of use as a means of controlling the sprouting of seed potatoes.

The work described in this paper was carried out as part of the programme of the Food Investigation Organization of the Department of Scientific and Industrial Research.

Some Articles of Outstanding Interest

• **NEXT MONTH** •

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PROGRESS IN THE CONTROL OF SWINE FEVER

B. A. CLAXTON, M.R.C.V.S.
Ministry of Agriculture and Fisheries

For several reasons, swine fever eradication is a very difficult problem in Great Britain. But a widespread programme of regular vaccination, allied to the existing control methods, can do much to reduce the number and severity of outbreaks.

SWINE fever was first recognized in the United States of America in 1833, and was probably carried in the early 1860s to this country, where it became established in 1862. It was declared a notifiable disease in 1879, and was dealt with by local authorities under the powers conferred upon them by the Contagious Diseases (Animals) Act of 1878. By this Act, local authorities were empowered to impose and enforce restrictions on infected places, and to slaughter affected pigs, as well as pigs which have been in contact with the disease. These measures were in operation for fifteen years, but they failed to reduce the number of outbreaks, and in 1893 the Board of Agriculture was asked to take over the control of the disease, the responsibility for which was transferred to it under the Diseases of Animals Act of 1894.

The history of swine fever administration since that date can be divided into two distinct periods. The first was from 1894 to 1915, when efforts were made to eradicate the disease by slaughter in conjunction with infected area restrictions of a permanent nature; the second from 1915 onwards, when the policy has been to control the disease by isolation and restriction of movement.

Early Control by Slaughtering Under the Swine Fever Order of 1893, the policy was to slaughter all pigs on premises where the disease was declared to exist, and also all other pigs on other premises which had been exposed to the risk of infection. But in July 1894 the policy of general slaughter was replaced by that of slaughtering only those pigs which appeared to be diseased or which were required for the purpose of diagnosis. This practice continued until early in 1896, when the Board reverted to the general slaughter policy of 1893. A reduction in the number of outbreaks ensued, and in 1900 the modified scheme of slaughter adopted in 1894 was reintroduced. In 1908 the slaughter policy was extended to include all the breeding stock on the infected place, in addition to affected and contact swine, in an endeavour to eliminate the risk of carriers.

In 1910 a Departmental Committee was set up "to inquire into the cause of the continued prevalence of swine fever in Great Britain and to report whether it is practicable to adopt any further measures with a view to secure its speedy extirpation". In the same year, trials were begun in two areas, comprising Scotland and the border counties, and Wales and some of the border counties (both of which areas were comparatively free from disease), with a policy of total slaughter of all pigs on the infected place and all direct contacts outside. By 1913, however, it was clear that, although these eradication measures had been rigorously applied, they had met with little success in Scotland and had been a failure in Wales. They were subsequently abandoned.

On the outbreak of war in 1914, swine fever procedure was varied so that slaughter of pigs on infected places was limited to pigs which were actually ailing at the time of diagnosis, and the slaughter of contact swine as a pre-

cautionary measure to reduce the risk of spreading the disease was resorted to as little as possible. The slaughter policy was abandoned finally in 1915.

The table below shows the number of outbreaks per year confirmed since 1894. The decline during 1896 and 1897 may have been encouraging, but subsequent history affords no indication that this diminution in the number of outbreaks was in any way due to the reintroduction of the general slaughter policy. After 1905 the number of outbreaks increased, and continued to do so, in spite of the extension of the slaughter policy to breeding stock in 1908. The figures in the table show that the modification of the slaughter policy in 1914 and its abandonment in 1915 had no deleterious effect on the swine fever position; indeed, a marked improvement occurred in 1917-18.

Swine Fever Outbreaks in Great Britain, 1894-1952

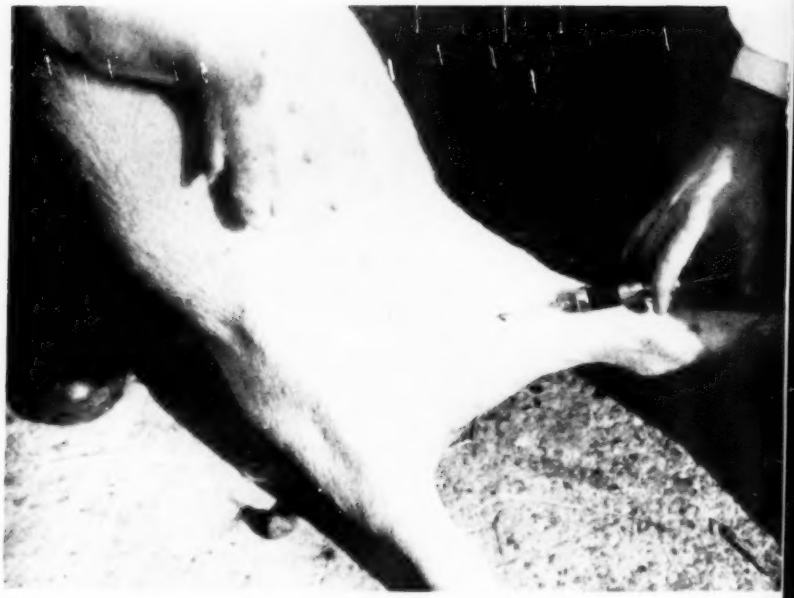
Year	Number of Outbreaks	Year	Number of Outbreaks
1894	5,682	1924	1,441
1895	6,305	1925	1,643
1896	5,166	1926	1,200
1897	2,155	1927	1,794
1898	2,514	1928	1,472
1899	2,322	1929	2,981
1900	1,940	1930	2,408
1901	3,140	1931	2,026
1902	1,688	1932	1,555
1903	1,478	1933	1,414
1904	1,196	1934	1,833
1905	817	1935	2,049
1906	1,280	1936	1,873
1907	2,336	1937	982
1908	2,067	1938	951
1909	1,650	1939	3,286
1910	1,598	1940	5,019
1911	2,466	1941	1,088
1912	2,920	1942	451
1913	2,573	1943	547
1914	4,356	1944	1,449
1915	3,994	1945	928
1916	4,331	1946	347
1917	2,104	1947	37
1918	1,407	1948	27
1919	2,305	1949	5
1920	1,816	1950	430
1921	1,285	1951	1,343
1922	1,390	1952	891
1923	1,968		

Success of Isolation Policy In 1915 the Departmental Committee, which had been appointed in 1910, presented its final report, having reached the conclusion that the extirpation of swine fever was practicable only by such drastic slaughter measures as to involve a prohibitive outlay and by such complete restrictions on movement as to be fatal to the industry of pig-keeping. The Committee recommended that the use of protective serum should be freely resorted to at the earliest possible stage in swine fever outbreaks, as a likely means of reducing the mortality from the disease. It is also interesting to note that the Committee was strongly impressed by the possibility of artificial vaccination being a method of combating the disease. The policy of slaughter, restricted and general, during the years 1894–1915, had cost over £1 million in compensation to pig-owners. This represented a net cost (that is, compensation less salvage) of approximately £800,000.

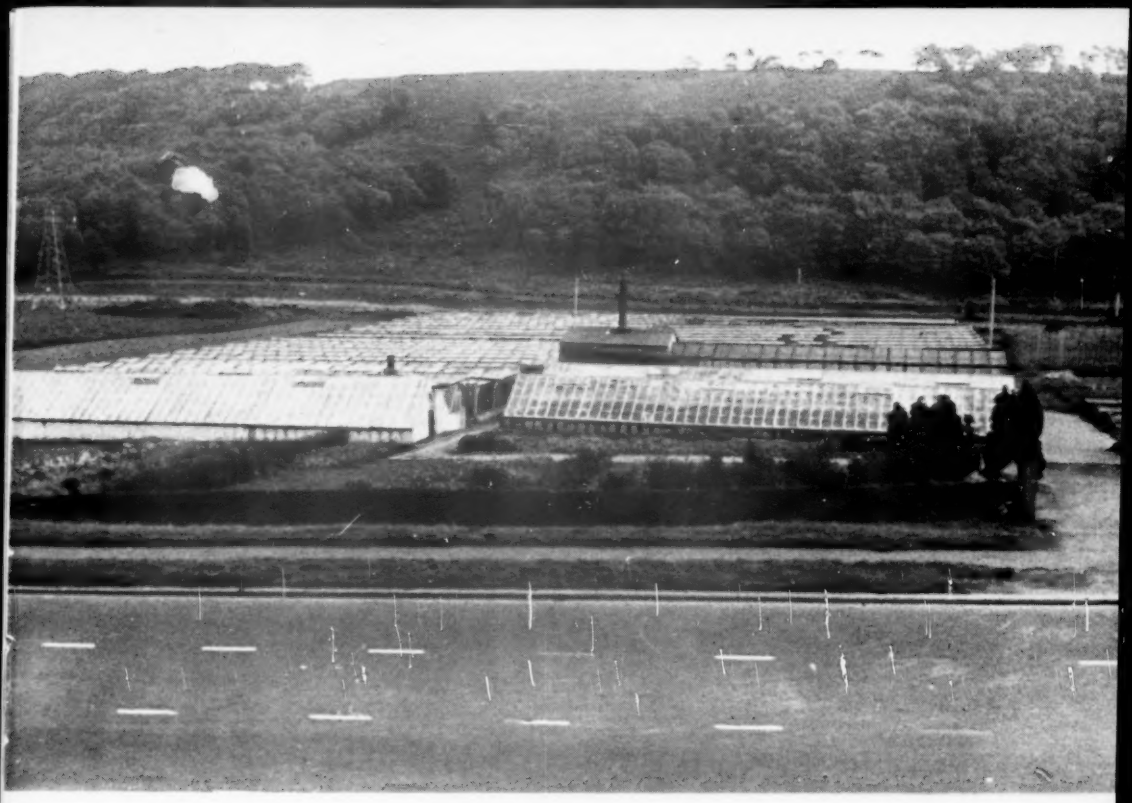
Crystal violet vaccine in preparation at the Ministry's laboratory at Weybridge, Surrey.

Bottling and labelling the vaccine

Injecting the vaccine.



Regular vaccination with crystal violet vaccine will prevent swine fever.



Seamer Valley Nursery
(see pp. 482–4)

above : The heated houses can be seen on the left, the cold houses on the right, and the packing shed in the centre.

below : In cold, windy weather the glazed sides of the heated houses are a great advantage.

Silage for Winter Feeding
(see pp. 458–62)
Waste-free silage is produced at Seale-Hayne in roofed tower silos.

Photos : *H. Ian Moore*

Potato silage is fed to fattening pigs from May until October.

PROGRESS IN THE CONTROL OF SWINE FEVER

Since 1915 the slaughter policy has been superseded by a policy of isolating every infected herd until the disease no longer exists. Since that date, the only pigs slaughtered by the Ministry on an infected place have been those which it has been found necessary to kill for the purpose of diagnosis. Serum treatment was then, and still is, explained to owners of infected herds. Veterinary officers of the Ministry are ready to give information and advice regarding the use of serum, but the decision to adopt such treatment, which is now given by the owner's veterinary surgeon, and the responsibility for so doing, must always rest with the owner.

In addition to the isolation of pigs on infected places, there has, with few exceptions, been permanent control over the movement of pigs from markets and dealers' premises, supplemented, when the occasion arose, by the temporary application of more stringent restrictions to any area where the incidence of swine fever has become especially high.

The table shows that there was a rapid fall in the number of outbreaks following the abandonment of the slaughter policy in favour of isolation. During the twenty-four years up to 1938 the number of outbreaks remained on a moderate scale (an average of about 1,500 a year), which was over 1,100 less than the average number (about 2,650) confirmed during the twenty-one years that the slaughter policy was in force. This state of affairs, coupled with the increasing number of pigs in the country, suggested that the precautions taken were, if not a complete solution, at any rate superior to the slaughter policy. Any sense of complacency was, however, rudely dispelled by the very rapid increase in the number of outbreaks in 1938–40. Incidentally, that rise was followed by an even more rapid decline, without any change in policy. During the last three or four years the number of outbreaks has again increased.

The history of swine fever during the last sixty years shows very clearly that neither slaughter nor isolation has been satisfactory in controlling the spread of the disease during certain recurrent periods. As has always been the case, the disease increases during the summer and decreases with the approach of winter, and there are good grounds for believing that the periodical and violent increases in the number of outbreaks are due to a change in the character of the virus, and that, as in the case of other contagious virus diseases, the swine fever virus undergoes periods of high infectivity separated by longer periods of lower infectivity.

Complete Eradication extremely Difficult There are certain characteristics of swine fever which render its eradication impracticable and its control a matter of considerable difficulty. The long period of incubation (which may be up to 30 days in some cases), the not infrequent difficulty of diagnosis (typical diagnostic lesions are not present in a substantial proportion of cases, thereby causing considerable delay in reaching a correct diagnosis), and the fact that the disease sometimes remains undetected (where the only sign of ill-health may be unthriftiness, and the pigs recover from the disease without the owner becoming aware that they have been affected, and so become possible carriers of the disease), obviously render any policy of eradication extremely difficult. These factors explain, to some extent, why methods of eradication which have proved successful in the case of foot-and-mouth disease and other contagious diseases are unsuccessful when applied to swine fever, and also why isolation and strict movement restrictions partially fail in their object.

It is also important to remember that fresh outbreaks are continually arising as a result of the importation of disease from abroad through the agency of infected pork and bacon which finds its way into the swill tub and escapes boiling. In the same way, so long as the disease is not eradicated, it is obvious that a number of pigs carrying the virus may be slaughtered for food, either in the incubative stage or as the recovered "carrier" pig, and thus the virus will be further distributed by bacon rinds and other waste from infected home-bred pigs contaminating pig food.

It has been shown that the virus of swine fever may remain active in frozen pork for upwards of 1,500 days, and for at least 27 days in bacon processed by pickling in sugar, potassium nitrate and common salt solution, followed by drying and smoking. The only possible way of avoiding the first danger would be by prohibiting the importation of foreign bacon and of frozen and pickled pigmeats from countries where the disease is enzootic. This, of course, is quite impracticable for reasons of national economics, and partial measures have to suffice. The risks are proportionate to the prevalence of the disease in the exporting countries, the volume of imports and the extent to which the protective regulations are not observed.

From 1940 there was a sharp fall in the number of outbreaks confirmed, the total in 1949 being only 5—the lowest ever recorded. This marked decline corresponds with the period during which less and less bacon and frozen pig products were imported from countries where the disease exists, and the pig population in this country decreased.

War-time experiences furnished considerable evidence regarding the importation of swine fever. Swine fever is enzootic in the United States of America and is not a notifiable disease, but it is controlled voluntarily by the farmers, chiefly by the use of the simultaneous serum and virus method of vaccination. The whole of Ireland had been free from swine fever for several years until shortly after United States troops arrived in Northern Ireland in 1942, complete with their own food supplies, including bacon. The disease then reappeared. After fourteen years' complete freedom from the disease, swine fever was reintroduced into Western Australia and New South Wales in 1942, following the importation of frozen pork to feed American troops based in the Commonwealth. In Morocco, where only three outbreaks of disease had occurred during the previous twenty years, the disease appeared in a most virulent form soon after the arrival of American troops. Later the disease occurred in Algeria, Tunisia, Italy, Corsica and, finally, in France, beginning in Normandy and extending to the north of the R. Loire.

Crystal Violet Vaccine In 1936 American workers conducted successful experiments with crystal violet vaccine against swine fever, and six years later the result of those experiments was confirmed in this country. Since that time, many experiments and large-scale field trials have been undertaken, and when the vaccine first became available there was no doubt that, properly prepared and used under suitable conditions, it would reduce the financial losses sustained by the disease and prove a valuable method of controlling its spread.

Crystal violet vaccine contains the causal virus of swine fever in an inactivated form and it confers protection against natural infection for at least twelve months. Before it is issued, the vaccine is subjected to bacteriological tests for sterility, and to potency tests in pigs. It is incapable of setting up the disease, and each batch of vaccine is tested for safety by inoculating eight times the standard field dose into a pig which must remain

unaffected by it. Crystal violet vaccine is solely a preventive of swine fever and has no curative effects. Indeed, vaccination of infected pigs appears to accentuate the severity of the disease and to hasten death. Healthy pigs of all ages may be vaccinated, but it is recommended that in pregnant sows vaccination should be restricted to the first half of pregnancy, and that unweaned pigs, whether the progeny of vaccinated sows or not, should be vaccinated from three weeks of age onwards.

The value of crystal violet vaccine is now well established. Unfortunately, vaccination is not carried out as a normal routine, but is resorted to in proportion to the extent of distribution of disease. The opportune time to vaccinate pigs is when the incidence of swine fever is low and there have been no outbreaks in the vicinity for several months. The need for care in the use of the vaccine which was stressed when the vaccine first became available still applies and warrants repetition.

The vaccine must not be expected to give maximum protection against swine fever to young pigs which are visibly affected with any of the commonly occurring diseases, such as anaemia, pig influenza and virus pneumonia, nor to pigs which are the victims of deficiencies of diet or bad management; it should on no account be used on ailing pigs. The vaccine has no value whatsoever except against swine fever and, as it does not confer immunity for about fourteen days after injection, it is important that it should only be used on healthy pigs which are not likely to be exposed to infection during the succeeding fourteen days. It follows, therefore, that normally the vaccine should not be used either on apparently healthy animals in an infected herd or on infected premises. For the same reasons, no recently purchased pigs should be introduced to premises during the twenty-eight days preceding vaccination, or for fourteen days after vaccination.

Twelve Months' Immunity without Risk Previously, every known method of vaccination against swine fever, including the simultaneous injection of serum and virus, exposed the inoculated pig to risk, and made it a source of infection to others. With crystal violet vaccine there is no risk to the individual pig, nor is there any possibility of disease being disseminated to non-vaccinated contact animals. Pig-breeders now have to decide whether they will have their pigs protected against natural attack of the disease, or whether they will run the risk of an attack of swine fever before deciding, as mentioned before, whether or not to attempt control by the use of serum.

Both serum and vaccine are comparatively costly, but, whereas the protective value of serum is only about ten days, that for the vaccine has a duration of at least twelve months. It is the method of production which keeps the cost of vaccine high, and for that reason the Ministry's Veterinary Laboratory is continuing its quest for more economic vaccines which will be not only cheaper, but will confer a stronger and more durable immunity. At the same time, the Ministry's Veterinary Laboratory is carrying out investigations to see whether the diagnosis of swine fever can be hastened or improved by new methods.

With the advent of crystal violet vaccine, the day cannot be far distant when every wise pig-breeder will have all his pigs vaccinated at least once a year, and never sell a pig until it has been vaccinated for at least fourteen days; when wise pig-feeders will only buy pigs which are known to have been vaccinated at least fourteen days prior to sale, leaving the unwise to

hold and to buy susceptible swine, and to take the consequences. The number of doses of vaccine issued and the number of outbreaks confirmed in the future will be the maximum and minimum recording apparatus of wisdom and despair.

The Minister recently announced in the House of Commons the introduction of a scheme for securing the more extensive and regular use of crystal violet vaccine. Particulars of this scheme, which came into operation on December 15, are given on p. 496—*Editor.*

THE ENGLISH FARMHOUSE

NIGEL HARVEY, M.A., Q.A.L.A.S.

All over the English countryside stand farmhouses which are stepping-stones in rural history. Mr. Martin S. Briggs, F.R.I.B.A. in his book *The English Farmhouse* (published by Batsford, 21s.) shows something of the wealth of interest that lies in these survivals of weathered timber, stone and brick.

THERE are approximately a quarter of a million farmers in England and Wales. They vary in industrial stature from the agricultural equivalent of the urban Big Businessman to smallholders who anywhere on the Continent would be described as peasants. They live and work in a country singularly varied in both soil and climate, and they have inherited much of the fixed equipment of their farms from a long line of ancestors who in different ages and in different ways have created or adapted it to meet their differing needs. The word "farmhouse" is, therefore, no more than a vague generic term, for each individual farmhouse is in large measure the local product of such human forces as history, economics and technical skill working within conditions imposed by nature. It is, in other terms, a sort of "structural document" which pleasantly and intimately records local circumstances, local life and local development, sometimes at one particular time, frequently over a period of generations or even centuries. The English farmhouse has, indeed, a very long and a very interesting history.

From Timber to Stone It is, however, the archaeologist rather than the traditional historian who can describe for us the first "farmhouses" in this country, the crude wooden huts of the pre-Roman peoples. It is the archaeologist, too, who has reconstructed in drawing and model the spacious and sophisticated villas of the Roman period which provided their fortunate owners with a standard of comfort, including central heating, not to be seen again for over a thousand years. Yet all this is no more than a prologue to the continuous history which only begins with the Saxon Conquest. The true ancestor of the modern farmhouse is not the prehistoric hut or the exotic villa but the thatched timber "hall" of our Early English forefathers.

After the Saxons came the Normans, and with them a highly developed form of the feudal system, so that the manor house began to dominate the village of which it was the centre. By this time stone was beginning to oust the timber of earlier times, and a few manor houses of that period survive to this day. But character rather than function was changing, for the manor

house was still a farmhouse. One mentioned by Mr. Briggs apparently contained a hall, a bower for the ladies, and, among the outbuildings, a barn, a cowshed, a pigsty, a brewhouse and a henhouse, while in another the rooms included an ox-house, a sheep-house and a lamb-cote, as well as a hall, a chamber and an ante-chamber. As the centuries passed, however, the houses of the wealthy became increasingly domestic in character and the farm buildings tended to retreat to a purely agricultural site. By the end of the Middle Ages, a typical manor house might contain a great hall with a minstrels' gallery, a dining-room, a kitchen and an upstairs "solar", but the outbuildings would be brewhouse and bakehouse, not stables, barns or cattle sheds. The older tradition was continued by farmers who lived as their lords had lived a century or so before them.

By the sixteenth or seventeenth centuries, however, the more prosperous farmers lived better than many a medieval lord. The "great hall" was passing away, for families now preferred the more private and peaceful life of individual rooms, and standards of comfort were improving. It was in this period, for instance, that the chimney became a normal feature of the dwelling-house, and the advice of Dr. Boorde in the *Dyetary of Health*, which he published in 1542, illustrates interestingly the domestic requirements expected by the new rulers of Tudor England. He refers to parlour and cellar and pantry-house, as well as to hall and kitchen; he recommends that stables, slaughter-house and dairy be sited a quarter of a mile from the dwelling-house, and even suggests that the moat "should be divers times scoured and kept clear from mud and weeds". The men of the Renaissance were not content with the manner of life of their forefathers.

It is in this period that Mr. Briggs abandons his purely chronological approach, for from then onwards there are sufficient surviving examples to illustrate local variations in design and material. He deals, therefore, with the farmhouses of the sixteenth and seventeenth centuries region by region and not generation by generation, and he wisely introduces each chapter with a brief description of the geology which determined the architectural character of each area. The eastern counties, for instance, depended mainly on flint and tile, reed-thatch, and timber framing infilled with wattle-and-daub and pargeted with lime plaster. The southern counties were richer in brick and also developed the distinctive technique of vertical tiles for added protection against the weather. The Cotswolds, of course, rejoiced in their superb limestone, and the beauty of the buildings of this period help to make these hills one of the loveliest landscapes in the world. To the west, first cob, then granite, predominated. In the heavily forested Midlands and Marches timber was the most common material, and in the north stone and such local specialities as "Westmorland blue slates" (which, by the way, are green and greyish in colour, and come from Lancashire) held sway. A particularly interesting section in Mr. Briggs's book deals with the forgotten farmhouses of London, including Ebury Farm, which surprisingly survived as late as 1870 near the present site of Victoria Bus Station. At the present time, it seems, the County of London contains only one relic of its vanished agriculture – Well Hall, near Eltham, a substantial farmhouse built in 1586.

Rural Revolution The next period, from 1700 to 1837, began quietly enough, the most striking feature of the first half-century being the reconstruction and improvement of the farmhouses in the wool areas with money made from the domestic weaving industry – Leeds and Halifax at that time still marketed home-made cloth. The point is interesting, particularly to an age which has come to regard the village as a purely

agricultural community, for it illustrates the importance of the crafts and trades which once added so greatly to the wealth and variety of rural life; the leaders of the old agrarian risings, for instance, were invariably craftsmen, not peasants. But the days of this familiar social order were numbered. In the next age, the Agricultural Revolution and the Enclosures dealt drastically with the traditional countryside, changing alike the system and equipment of farming, the relationships of men, and even the physical landscape itself.

In so doing, however, this rural revolution called into existence many, perhaps most, of the farmhouses and buildings which still serve us today. This was the age of the comfortable, secure, spacious farmhouse, often encircled by trees to protect it from the winds which blew over the newly-hedged landscape where once the immemorial open fields had stood. It was also the age of the industrial buildings, which made such prosperity possible; of the yards where cattle fattened on the new root crops and trampled straw into manure for the huge corn acreage of Napoleonic times; of the great barns where the harvests were threshed, generally by hand, sometimes by the new machines which Trevithick and his colleagues were developing; of the stables which housed the mobile power of a predominantly arable system. You cannot go far in the modern countryside without seeing something of the work of our tireless great-grandfathers, the masterful men of the New Farming.

Less attractive was that curious by-product of the economic developments of the time—the peculiar strain of artificial whimsy which, for reasons blisteringly analysed by Cobbett, began to infect rural architecture. It was, admittedly, more successful on paper than in reality. Octagonal farmsteads, Grecian cowhouses which could be "converted into the Gothic Style" by increasing the pitch of the roof and adding buttresses and pointed arches at suitable intervals, and "farmeries having the appearance of monasteries" are mercifully rare embellishments of the agricultural landscape. But the pseudo-technical treatises which seriously recommended these and similar fantasies were numerous and, apparently, popular. Mr. Briggs has found some thirty specimens of the shoddy and pretentious literature produced by this movement which strove to degrade farmhouses and farm buildings into ornamental features on an elegant estate or pleasing incidents in the prospect from the windows of a mansion. Incidentally, Mr. Briggs might have mentioned that even Loudon, perhaps the healthiest and most practical representative of this deplorable school, was able to reduce the estate he served to near-bankruptcy in a matter of half-a-dozen years.

For the last chapter, which ends in the year 1901, we leave *la ferme ornée* for the purposeful and practical work, both literary and structural, of such men as Dean, Stephens, Burns and the incomparable Denton. We are now in the world of the High Farming, of the model steading, of steam-power and a specialized and highly competent professional literature. And it is significant that the farmhouse formed but a very minor part of these Victorian homesteads. For by this time the redeemable waste was nearing exhaustion and the reclamation of new acres was yielding to the fuller exploitation of existing land. Therefore farm buildings, which are in large measure tools for reducing waste of labour and manure, depreciation of equipment and injury to animal quality came into their own as a means of increasing production in a country which allowed little expansion of the agricultural area.

Such in outline is the story of the farmhouse which Mr. Briggs tells, and he tells it fluently and pleasantly in a frankly popular book which makes no claim to originality or deep scholarship. It is superbly illustrated, with drawings and photographs which range from a reconstruction of the Roman

villa at Chedworth to a farmstead of the 1850s. The photographs in particular, are beautifully taken, wisely chosen and reproduced with the peculiar artistry of which the publishers, Messrs. Batsford, are masters. One of them, a fifteenth century farmhouse, is reproduced on the cover of this issue of the JOURNAL.

Some Criticism The rural reader, however, may find this book disappointing, for as a history, even as a popular history, it is regrettably superficial and incomplete. There is, for instance, little reference to the various historical influences, such as the establishment of law and order by the central government and the coming of cheap and convenient transport by canal and railway, which throughout the centuries have so modified rural architecture. Neither are we told that many of the old farmhouses are now cottages, reduced in status along with their inhabitants, the land-occupying peasantry of the open field times whom the enclosures converted to labourers working for hire on somebody else's land. To this day, you can still sometimes see behind old cottages the decaying outbuildings which were once the barns and byres of our Old Farming ancestors, the last relics of a rural polity which has now passed into history; but you will not find pictures of such buildings in this book.

Further, and perhaps more seriously, Mr. Briggs specifically includes farm buildings in his terms of reference, but his treatment of them is less than adequate. In general, he deals with them as though they were mere appendages of the farmhouse, whereas they are in reality an independent class of building with their own functions, their own standards and their own history. In particular, he vouchsafes little attention to the agricultural needs of which these buildings were the product, and relies too much on purely architectural sources—for instance, he discusses the buildings of the New Farming without mentioning the *County Reports* of the First Board of Agriculture. Yet it is only in agricultural terms that the industrial buildings of our countryside can be fully understood and appreciated.

But perhaps it is unnecessarily pedantic to criticize in too great detail a book which is clearly intended to do little more than prepare the man-in-the-street for his country holidays. And, indeed, it will give the general reader at least a great deal of interest, information and enjoyment.

SEAMER VALLEY NURSERY

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Development from three acres and a few Dutch lights to thirty-seven acres with a considerable area of steam-heated and cold glass devoted to horticultural production, is no mean achievement; but these are the facts underlying the story of the progress of Messrs. Quartons' gardens at Scarborough.

IT was in 1936 that Mr. G. F. de Bruin, the present managing director of Messrs. Quartons, began market gardening on three acres of land at Stoney Haggs on the outskirts of Scarborough, in the attractive Seamer valley. The aspect was southerly and the soil a light, well-drained loam overlying a gravel subsoil, so that the site was well suited for early work. Early strawberries had always interested Mr. de Bruin, and it was not surprising, therefore, that a large proportion of the original 500 Dutch lights were used to cover a crop of frame strawberries. The production of this crop has been, and still is, an interesting feature of the firm's activities. The remainder of the lights were devoted to a late crop of French beans, which became the first cash crop to be taken off the gardens.

In 1937, following normal Dutch practice, the lights were transferred to a structure to cover tomatoes, but departing from normal practice, a heating system was installed. A move was thus made towards making Dutch houses more permanent – a trend which has developed rapidly in more recent times. The heating system was of the standard type, utilizing a coke-fired boiler and 4-inch hot-water pipes.

In the two years immediately before the war expansion proceeded apace. Dutch lights were still comparatively new to the area – and even more so to the rest of the country – and it was, therefore, not without local comment that a one-acre block of Dutch lights appeared in 1939. It is interesting to note that the Dutch structures built on these nurseries, then and since, were of the traditional Dutch pattern with certain modifications. To increase the effective growing height, the houses were erected on 7-foot posts instead of the usual 6-foot, and frequently the side Dutch lights were replaced by glazed side framing. In an area exposed to cold north-east winds in the early months of the year, the advantages of the latter are obvious, but it does further emphasize the point that the structures were built to be semi-permanent, although the roof lights could be taken off occasionally to allow the soil to "weather".

The total glasshouse area was now 1½ acres on 3 acres of land, so it was obvious that much more land would be needed if expansion were to continue, and, fortunately, it was found possible to acquire 4 adjoining acres at Stoney Haggs and an additional 30 acres at Crossgates, a little over a mile away. For a while the extra land at Stoney Haggs was devoted to salad production, whilst at Crossgates more extensive market gardening was practised. However, it was not long before the inevitable Dutch lights made their appearance at Crossgates, and gradually the glasshouse area there was increased to 2½ acres. Meanwhile, the area of glass at Stoney Haggs was expanding both in normal timber structures and in single-bay metal structures built to the firm's own design, using scrap angle-iron.

The two nurseries thus developed side by side, producing both vegetable and salad crops for direct retail sale. On the production side, special emphasis was laid on certain aspects. Early consideration was given to the building-up of soil fertility and, in view of the nature of the soil, great stress has

rightly been laid on manuring with farmyard manure. The normal annual dressing has been 50 tons per acre, but it is rather unusual to find that it has not been considered necessary to supplement this with fertilizers to any marked extent. It can be argued, however, that in some cases weight of crop has been subservient to production cost.

Overhead Irrigation The very nature of the soil meant that irrigation was a necessity if large labour bills on watering were to be avoided, and it was, therefore, fortunate that an excellent mains supply was available at a pressure of not less than 40 lb. per square inch. Maximum use has been made of this, and all structures as they were erected were fitted with overhead irrigation lines incorporating mushroom-type nozzles. Experience has shown that the latter give a very effective cover, and the watering of all crops in structures, including tomatoes, is carried out entirely by this system without adverse effects, although care is taken when watering tomatoes not to spray too late in the day. On the other hand, irrigation has not been widely adopted with flat frames and, indeed, the tendency to use structures instead of frames has increased in the face of rising labour costs. In the days when frame cucumbers were profitable, the system of watering was crude but ingenious. Irrigation pipes drilled at intervals were placed under the ridge, and the water splashed on to a piece of glass and thence to the crop.

Soil sterilization, either by steam or chemicals, seems alien to the Dutch method of culture, and it is not surprising, therefore, that no attempt has been made to adopt this rather expensive practice at either Stoney Haggs or Crossgates. The structures may remain permanently glazed for up to seven years before they are moved to a fresh site, but during that time great importance is attached to thoroughly spraying the structure and soil surface with formaldehyde or one of the proprietary sterilants.

To achieve a better crop rotation at less labour cost, an experimental mobile structure was designed by Mr. de Bruin to cover chrysanthemums, daffodils, tulips, asters and iris in quick succession. The structure is of the single-bay type of welded angle-iron construction similar to many of the more permanent structures on this holding. Welded near the base of each side is a runner, in section like a very shallow inverted U. Concrete dolleys at 8-foot intervals are set in the ground to cover the total traverse of the house, and, mounted in a bearing on the top of each dolley, is a small diameter wheel which moves in the runner. The present house is 40-feet long. Six men can move it fairly easily, but it could be moved with less labour using a winch.

Flowers and Strawberries Flower production, which was started on a small scale in 1939 at Stoney Haggs but relegated to the background during the war, began to develop in 1947, and today the 7 acres of Stoney Haggs are devoted almost entirely to flower-growing. Forced bulbs, sweet peas, stocks, gladioli, chrysanthemums and pot plants are produced under glass, and in the open the range is increased to cover a wide variety of annuals and perennials.

As mentioned earlier, frame strawberries are an interesting feature of the cropping programme. After the initial venture at Stoney Haggs, the stock was lost during the war and a fresh start was made with 200 lights at Crossgates in 1946. This is probably one of the few nurseries in the country where the variety Deutsch Evern is grown commercially, and results compare extremely favourably with those from other varieties. Until recently runners

were taken from fruiting beds and new stock imported from Holland every few years, but now that a runner production bed has been established away from the fruiting frames, it is hoped to be able to maintain a clean stock of this useful variety. The plants are put out at fifteen to a light, and it is unusual if the crop does not average more than 6 lb. per light of really early fruit – earlier than any other variety. With the high prices obtained for such produce, it is not surprising that 500 lights are now down to this crop.

One of the chief drawbacks to forced bulb flower production has always been, and is more especially so today, the high price of the bulbs. In view of the suitability of the soil at Crossgates, Messrs. Quartons decided to grow their own bulbs, and an area of land was devoted to this work, resulting in the production of a considerable weight of untreated bulbs for later forcing.

Low Pressure Steam Heating The piecemeal development of Stoney Haggs nursery, like that of many other nurseries, resulted in an extremely extravagant heating system, utilizing four hand-fired coke boilers situated in various parts of the holding. With the rapidly increasing cost of fuel and labour, it was becoming impossible to run the glasshouses economically, especially for early flower production. Something had to be done, and the choice fell upon low pressure steam as a system which fitted in well with the mobile type of glasshouses to be heated. The installation has been running satisfactorily now for two years and has definitely resulted in reduced fuel expenditure and increased heating efficiency. Initially the system was not fully thermostatically controlled, but experience has shown these controls to be necessary if the most economic fuel consumption is to be obtained. It is interesting to note that, with the exception of the propagating houses, all the heated houses are of the Dutch type, and it is not found that heat losses are excessive. In cold, windy weather, however, the glazed sides are a great advantage.

Arising out of the change-over to steam heating, came an interesting observation. It had been the practice each year to plant up several of the single-span cold structures with bulbs, and it was a matter for some conjecture when the crop at one end of the houses began to develop much faster than at the other. The phenomenon was, however, easily traced to the flow from the condensate tank of the low pressure heating system to the boiler. The small diameter pipes, even though buried 18 inches deep, were exerting a considerable effect on the soil temperature in that area. Subsequent thermometer readings confirmed that whereas the general soil temperature in the house was only 44°F., the surface temperature of the soil immediately above the pipe was 50°F., and for a distance of 3 feet on either side there was a drop of only 2°F. The temperature of the condensate pipe was 140°F. The flowers on this warmed soil developed to perfection without space heating much earlier than the rest of the house.

This unforeseen occurrence led to a trial of controlled soil warming on glasshouse cucumbers, using buried ½-inch steam pipes laid inside 2½-inch land drain tiles to reduce drying out. The result was highly satisfactory: cucumbers planted in April were yielding their first cut three weeks from the time of planting and gave a heavy yield. It is hoped to develop the system for forcing early bulbs direct in the glasshouse soil and thus cut out the expensive boxing operation.

The principles dominating the development of these nurseries have been economy of production and direct marketing to the consumer. Detailed records of costings are kept, which, of course, are essential if a horticultural undertaking is to continue to be profitable.

CUT FLOWERS FOR MARKET

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Flower-consciousness among the public is growing, and there is a demand for cut blooms throughout the whole of the year. But the grower has to ensure that he can produce them economically.

IT seems that there is likely to be quite a big demand for well-grown cut flowers in the future. Flower decoration groups have arisen in various parts of the country. At least three women experts have written books on the subject and travel throughout Great Britain giving lectures. Articles are appearing frequently in gardening papers and in other periodicals and for the first time an official adviser on floral decoration was appointed to the Coronation.

Over the past twenty-five years four distinct groups have emerged in the cut flower industry: the glasshouse men who specialize in carnations, roses, etc., the chrysanthemum specialists who grow nothing else and aim at keeping up the supply from at least August until the following February, the "specialist" outdoor growers of violets, gerberas, etc., and lastly the growers who are content to produce cut flowers out-of-doors for as long a period as possible, aided perhaps by cloches.

The exclusive floral shop at one time used only to be found in the bigger cities like London, Liverpool, Manchester and Birmingham, but now we can find shops specializing in flowers in country towns as well; their owners tell me that it pays them far better to keep to flowers rather than introduce vegetables or fruits. This year, when prices for horticultural produce have been generally poor, cut flowers have regularly sold fairly well.

In view of the high cost of fuel, it is not going to be easy for the man with glasshouses to produce his flowers economically. This year the returns for good carnations, for instance, have been extremely disappointing. The returns for August shown to me by one big grower were as low as 7d. a dozen, after the normal market charges had been paid. There is a lot to be said, therefore, for the perennial which grows out of doors, needs the minimum of labour and whose flowers are produced over a definite period.

Pyrethrum At Thaxted our plan is to try and keep up the supply of perennials throughout the year, starting as a rule with pyrethrum – Harold Robinson, the red, Eileen May Robinson, the pink, and Kelway's Glorious, the early scarlet crimson, all with strong, erect stems. The secret of success with pyrethrum is undoubtedly the propagation by division of plants in July, immediately after the first flowering period. The planting must be done carefully and well, for the roots have to be spread out evenly. Picking should be done as early as possible in the morning, bunching to twelves, and the flowers then put into water up to their necks for at least an hour (preferably two) before packing. The stems should always be as long as possible. We find that the returns work out at $1\frac{1}{2}$ bunches per plant in the case of two-year-olds and 2 bunches in the case of three-year-olds. The average price received this year, selling direct to retailers, worked out at 6d. a bunch.

It pays to standardize the beds. At Thaxted we go on the principle of five rows a foot apart to the 4-foot bed. This makes for ease of cultivations,

and the 2-foot temporary paths between the beds make picking a pleasure. It is not difficult either to push in bamboo canes 6 feet apart along the edges of the beds and to stretch binder twine in between to prevent the flowers from toppling over. The moment the main cut of the bed has taken place the bamboos are taken down, the bed gone over so that the rest of the flowers can be removed, and the plants generally tidied up and cleaned. Then down between the rows a fish fertilizer with a 5 per cent potash content is applied at about 3 oz. to the yard run, and hoed in by hand.

For some years we were not able to find a suitable perennial to follow pyrethrum, but eventually the aster (*Yunnanensis napsbury*) was introduced – a discovery indeed. It is hardy and prolific, never needs staking, is very attractive with its golden centred eye, and the beautiful mauve petals are round. Two-year-old plants on an average produce one bunch per plant and three-year olds just over a bunch and a half, but the tendency at this stage is for the stems to be shorter. We therefore prefer to re-plant the beds every two years and thus get a lighter weight of crop but a longer stem. The average price for good bunches of twelves also worked out at 6d. each.

Chrysanthemums For years we grew various varieties of the *Chrysanthemum maximum*, starting with Doris Turner, the earliest, and going on with Silver Jubilee, Ryecroft Early, and so on. Then came the introduction of the doubles, and immediately we turned over to Esther Read, which will produce white blooms of lasting quality, measuring 4 inches in diameter. Horace Read has never given us sufficiently heavy crops. Jennifer Read is too expensive to buy in a big way just now, though we have a few promising plants; Cobham Gold has certainly got a gold centre to it, but is not the pure gold we hoped it was going to be.

At the moment our special interest is centred on Wirral Pride, which is cropping very heavily indeed. The two-year-old plants easily produce two bunches per plant, and so per area of ground it has given us the biggest return. The double white flowers fetch as little as 4d. or 5d. a bunch but if the blooms are dyed skilfully by the absorption method, the demand is immediately increased, and the price as well. The bunches of our best dyed Wirral Pride made 1s., and a seasonal average of 9d.

Retailers, of course, have their own choice as regards actual colours. There is little demand for the blues, a fair demand for the reds and pinks, and some shops favour the golds and bronzes. Many people are shocked when I refer to dyeing flowers, but in point of fact no harm is done. We have discovered that after dyeing the blooms last far longer in water than before – on an average three to four days longer, and some buyers have said as much as a week. There is nothing wrong in "painting the lily".

The method of dyeing is simple. The powder is dissolved in water and poured into a galvanized container into which the bunches of flowers are placed *immediately* they are picked. The dye then starts to rise up the stems and colours the petals. The moment the right tinge appears the bunches should be taken out of the dye and put into clear water; the dye will continue to be absorbed until the petals are fully coloured. One learns with experience when exactly to take the bunches out, for if they are left in too long the colours become bold and unnatural.

Our early chrysanthemums are grown in what we call three-row blocks, 14 inches apart each way. We tried standardizing them down to 12 inches but it was not successful. The average number of blooms per plant works out at about nine, and price depends very much on quality, variety and

market. Our average this year was as low as 3d. per bloom, though a grower I know in the Ipswich area achieved an average of nearly 5d. The mathematicians will work out the difference in £.s.d. between the chrysanthemums in three-row beds with a 2-foot path in between and, say, scabious at 1 foot apart in 4-foot beds with 2-foot paths in between. It is not, however, much use showing that the chrysanthemums make more money per area of ground until you take into account the high cost of production, the cost of fuel and the upkeep of the glasshouses which must be available if these flowering plants are to have their right start.

Scabious *Scabiosa caucasica* is another of the simply-grown, heavy cropping types of perennials which should be included in any cut flower grower's programme. There are a number of varieties sold commercially, perhaps the best of them being Clive Greaves, though in the south-west I have frequently come across Goldingensis and Pride of Exmouth. My own observations suggest that there may be two or three strains of Clive Greaves: there is one which is particularly floriforous and seems to abound more in Cheshire than in other parts of the country.

The great advantage of scabious is that the plants go on cropping for a very long period; they may well start at the beginning of July and are often flowering right at the end of the season until the plants are cut down by frost. Northerners tell me that the main cut is during the month of August. And this is probably true because it is at that season that the price tends to drop. Good one-year-old plants that have been propagated by the division of groups in the spring will produce on an average one bunch per plant, and the price over the whole season, selling locally in Essex to retailers, averages out at 6d. per bunch. Adequate time is essential for success with this crop.

It is a far simpler matter growing a perennial of this type than, for instance, setting out to produce chrysanthemums by the thousand, entailing sterilizing the stools, making certain that they are free from eelworm, striking the cuttings in John Innes compost, setting the struck plants out into sterilized soil in frames, and giving the necessary protection until all fear of frost is passed. Even when the plants are out in the open ground, there is all the disbudding, stopping, spraying to control capsid bugs and leaf miner, plus of course some method of supporting the plants.

During the last few years we have seen the decline and fall of annuals grown in the open. Time was when cornflower and nigella would sell well, but not today. There is still a small demand for these blooms produced very early with the aid of cloches, but nowadays the public are turning to the longer-lasting, well-grown perennials. The exception to the rule perhaps is the Chabaud carnation, which is proving a very interesting speculation since we were able to obtain the right long-stemmed varieties from abroad. But here again, the problem with these beautiful flowers is the fact that the plants have to be raised under glass from January sowings.

LIQUID MANURE HANDLING IN NORTH STAFFS

J. J. COADY, M.Sc., and A. J. B. RATCLIFFE, N.D.A.
National Agricultural Advisory Service, West Midlands Province

A recent investigation carried out by the N.A.A.S. in North Staffordshire shows that with the help of modern handling equipment, many local farmers are making greater use of liquid manure to fertilize grassland.

THE use of liquid manure, although attractive, has in the past thrown up problems in practice. But many North Staffordshire farmers have recently shown considerable interest in the possibilities of this type of manure, and, as the results of an N.A.A.S. investigation show, are utilizing it most successfully. The reasons for the increased popularity of liquid manure are not difficult to discover. On many farms a disused storage tank can usually be found without much difficulty, and modern equipment has enabled the arduous task of handling to be performed more economically than before. No doubt, too, the general rise in costs of production and the relatively high cost of fertilizers has further stimulated them to consider ways of using a valuable material which otherwise is wasted.

During the course of the investigation, visits were paid to over fifty farms where liquid manure is regularly conserved and applied to the land. On several of these detailed time and labour requirements were noted, and a few specific examples are included in this article. Much more work is required before definite recommendations can be made, but many of the farmers visited were satisfied that they had put the utilization of liquid manure on to an economic basis comparable with that of fertilizers.

Several analyses of liquid manure were made during the survey to find the most suitable application rates per acre. Three typical results are given in Table 1.

Table 1
Analysis of Samples of Liquid Manure

SAMPLE NO.	ANALYSIS (PER 1,000 GALLONS)			EQUIVALENT MANURIAL VALUES		
	N	P_2O_5	K_2O	Sulphate of Ammonia (21% N)	Superphosphate (18% P_2O_5)	Muriate of Potash (50% K_2O)
	lb.	*lb.*	*lb.*	*cwt.*	*cwt.*	*cwt.*
1	40	2	30	2	0.11	0.7
2	10	1	20	0.5	0.05	0.4
3*	70	40	100	3.5	2.22	2

*Solid manure was found to be mixed with the liquid in this case.

The actual application rates varied from farm to farm and ranged between 1,500 and 6,700 gallons per acre, but from the analyses above it would seem that to give a reasonable dressing a yearly application of 1,500–2,000 gallons per acre is desirable. Obviously, attention to the analysis and application rates is extremely important if a specific manuring policy is to be closely followed.

Liquid manure in North Staffs is chiefly applied to grassland, and it is given regularly throughout the winter and spring. During the survey it

Table 2

METHODS OF HANDLING LIQUID MANURE

Farm	No. of Cow-Equivalents	Storage Capacity of Tank	Method of Filling Spreader	Rate of Loading		Capacity of Spreader	Rate of Spreading				Width of Spread	Rate per Acre	Total Time per 1,000 Gallons
				Gallons per Minute	Man-Minutes per 1,000 Gallons		Spreading Time		Man-Minutes per 1,000 Gallons				
		gallons				*gallons*	*min.*	*sec.*	*min.*	*sec.*	*feet*	*gallons*	*minutes*
1	43	4,850	Diaph. pump, I.C. engine	50	20	250	1	5	4	20	6	3,903	24
2	25	3,500	Hand chain	19	53	115	2	—	17	—	3	1,815	70
3	78	2,600	4-inch pipe, gravity fed	236	4	550	11	12	20	—	7–8	1,512	24
4	38	5,000	Electric centrifugal pump	62	16	500	8	10	16	20	6	1,890	32
5	27	7,000	3-inch pipe, gravity fed	250	4	550	8	—	15	—	17	2,016	19
6	31	1,660	Suction tank	33	30	250	1	40	6	40	6	6,722	37

Note : The travelling distance from yard to field was not calculated.

was noticed that it was also applied to fields after an early bite, to leys cut for hay or silage and occasionally to kale and cabbage. Cattle seemed to graze pastures quite readily a few days after its application.

Size and Siting of Storage Tank The size of the storage tank required naturally depends a great deal on the number of cows in the herd and the frequency with which the tank is to be emptied. In assessing the storage capacity needed, however, roughly 50 gallons of urine and washing down water per cow per week should be allowed for. It appears unnecessary in most cases to separate washing down water from the urine; in fact, it has been found that undiluted urine can, under certain conditions, cause scorching of the herbage, so that some measure of dilution is therefore advisable. But excessive dilution by rainwater from other drains should be avoided. The tank should also have a close-fitting, manhole-type cover to prevent atmospheric losses.

The actual siting of the tank is important. In two instances this was arranged on the side of a slope, below the farmstead, so that it could be emptied into the spreader by gravity. In circumstances where this is not possible, a pump will have to be used and the tank placed as close to the cowshed as possible. Where the storage tank was emptied by gravity, high rates of filling into the spreader were recorded (see Table 2), the liquid being transferred at over 200 gallons per minute.

In those cases where a pump was necessary to raise the liquid manure from a lower level, many different methods were used. A recently renovated, hand chain pump proved too slow and tedious, as well as being expensive in manpower. At the other end of the scale, one farmer had designed and constructed a rather elaborate pump-house with an electrically-driven, 3-inch centrifugal pump and two propeller agitators for the thorough mixing of the sediment and liquid in the tank. This type of pump delivers approximately 60 gallons of liquid per minute, but the capital cost of such an installation can obviously only be justified by the handling of larger quantities than are usual on the average farm. A simple type of engine-driven diaphragm pump was used on another farm investigated, and, with the reasonable capital cost, simplicity and a rate of work comparable with any other type of pump, this may well prove the answer in many instances. Recently patented vacuum suction tanks gave useful rates of work, and they have the advantage that no moving parts are in contact with the liquid manure; moreover, after filling, the tank is immediately ready for use in spreading.

Spreading Apart from the vacuum tanks, the spreader in every case had been constructed by the farmer. It consisted usually of a suitable tank mounted on wheels, with an outlet valve at the rear feeding on to a fluted board to give the necessary width of spread. In one case, a spreading disc was driven by chains and geared from a trailer land wheel. This gave a wide, even spread and was not affected so much by uneven or sloping ground. It had the added advantage that, by raising the trailer slowly with the hydraulic tipping gear as spreading proceeded, a constant head of liquid could be maintained, and there was little falling off in flow.

This survey has shown that some North Staffordshire farmers have successfully incorporated liquid manure into their farming programme and overcome many former disadvantages associated with its handling. On this evidence it should be well worth while for all dairy farmers to investigate the possibilities of handling liquid manure on their own farms.

FARMING AFFAIRS

Green Farm The latest developments in commercial egg production seem to indicate a swing from extensive to intensive systems of management, and it is therefore of interest to be able to look for a moment at the methods adopted by one of the most successful protagonists of the free range system. The opportunity to do so arose at the recent Peterborough Poultry Conference, when Mr. W. A. Crawford, who farms 700 acres at Watton, Norfolk, spoke on the part poultry can play in the farm rotation. To Mr. Crawford, natural methods of poultry management, allied to the old principles of good husbandry, still form the soundest long-term policy for the poultry industry. In support of his argument, he instanced his own farm, where for many years a healthy breeding stock has done much to assure an economic and profitable poultry unit contributing greatly to the general fertility of the farm.

The farm rotation at Watton is oats—wheat—sugar beet (or beans)—and barley undersown with a three-year ley mixture consisting of 20 lb. Kentish indigenous ryegrass and 2 lb. Kentish wild white clover. Occasionally two crops of barley are taken, so the poultry moving round the farm return to the same land only once every seven or eight years.

To obtain the maximum returns from the grass, balanced grazing is aimed at. The livestock kept consists of 200 Masham ewes and their followers, a dairy herd of 60 cows, and approximately 200 cattle of different ages for feeding and dairy replacements. Calves are reared on the multiple-suckling system, averaging four per cow, and culls from the dairy herd are used as foster mothers. The laying flock comprises 8,000 birds, including 1,700 breeders, while approximately 20,000 chickens are hatched every year. All hatching eggs surplus to requirements are sold to hatcheries.

After leaving the brooders, young birds are fed solely on grain and are encouraged to eat plenty of grass, while ample supplies of grit are provided. Mr. Crawford has found that this system develops a strong gizzard and large crop, which is of material advantage during the production period. The laying flocks are given a wet mash feed in the morning and grain in the afternoon. This leaves ample time for grazing on free range and also enables the birds to pick up an appreciable amount of their protein requirements from the soil. The protein content of the mash is varied according to the season of the year and condition of the birds. When grass is short, chopped kale or steamed potatoes have proved very successful as supplementary foods. All rations for layers are mixed and balanced on the farm, and great care is taken at harvesting to ensure that combining or stacking takes place under the best possible conditions.

Storage accommodation has been built for 4,000 sacks of corn, and a drying plant is now being installed so that all corn can be fed with a moisture content of less than 14 per cent. Mr. Crawford considers it is imperative that, for the best results, birds should go to roost with full crops of hard, dry grain. The leys are kept in short, succulent condition by grazing them with different classes of stock and cutting for silage during periods of lush growth, and this probably accounts for the name "The Green Farm" being used by the many visitors who come to study the Crawford system of management.

The layers houses, which measure 24 feet $\times$ 12 feet, are moved twice a year to clean ground to reduce the danger of disease to a minimum. The cross-bred growing chickens are put out on grass in arks from four weeks old, while the chicks intended for the breeding flock are reared outside in brooders from three days old.

The system of management has been amply justified by results, as for many years Mr. Crawford's entries have won prizes in the foremost laying

trials. Since all-the-year-round egg production is aimed at, no artificial lighting is used, but the flock has regularly maintained over 60 per cent egg production during the winter months. Last year a flock of 4,650 cross-bred pullets averaged 216 eggs per bird housed. All poultry-houses are cleaned out at least once a week, both in the rearing and laying stages. A mixture of combined barley straw and cut wheat chaff is used for bedding, and is ideal for the birds to scratch in.

In Mr. Crawford's opinion the most important pointer to economic egg production is the food conversion ratio. As long ago as 1920 experimental work by the organizers of the Leicestershire Laying Trials showed that 97 lb. of food was producing 240 eggs per bird entered by Mr. Crawford, and the same strains of birds are producing similar results on the farm today. Conversion figures of this order could not be achieved, however, without making the maximum use of grass, sunshine and fresh air.

W. J. S. Fordyce

Farming Cameo : 37. Cuckfield, East Sussex

From the coast at Brighton, Hove and Portslade, with the South Downs behind, this district, often referred to as mid-Sussex, stretches to the forest areas between Crawley and East Grinstead and covers about 50,000 acres of farm land. Travelling due north from the sea, one passes first through the chalkland farming of the Downs, which has in the past seen so many violent changes—the change-over from the folded flocks of Southdown sheep to grassland and cattle, the extensive ploughing-up and corn growing in 1939, the requisitioning by the Army for use as a training area, and finally its restoration by the County Committee and return to farmer-occupiers.

Most of the farmsteads and cottages destroyed whilst under military occupation have now been restored, and, with the stimulation provided by the ploughing and marginal land grants, further large stretches of scrub and gorse have been cleared and brought under the plough. Fencing and the provision of water has been put in hand, so that not only can a ley system be practised, but the steep, unploughable slopes can now be put to better use. Farms in this area are relatively large and, in recent years, have become highly mechanized. Most farmers run a dairy herd, usually milked on some form of parlour system. Sheep still remain on the Downs, and in the last few years have been gradually increasing in numbers. Usually, a breeding flock is kept, although, with few exceptions, a grass flock of the Clun, Half-bred or Kerry type has taken the place of the folded Down breeds. Farmers who keep no permanent flock take in " keepers " from the Romney Marsh area to run during the winter.

A short distance from the northern edge of the chalk, one strikes a narrow belt of Lower Greensand, which gives rise to good mixed farming with the emphasis on market gardening. The soil is naturally fertile, so that when well farmed it can produce high yields of both tillage crops and grass.

North again of this belt is a section of the true Weald Clay of Sussex, with its silty, loam soil of only medium natural fertility. Most of the farms here are in the 70–200 acre range, and concentrate on dairying. Fields are relatively small—mostly about 6–12 acres. The area is well wooded and has a noticeable amount of hedgerow timber. Land drainage is a most important factor; where it is in good order and the necessary fertilizers given, many farms produce very good crops. Winter wheat yields of 12–15 sacks per acre are not uncommon. However, as one might expect, over half the farming area is in grass.

The predominant soil deficiency in this Weald area is usually phosphate, so basic slag has always been regarded as the key to better grassland. Phosphate is still important, but for the really high grassland production now sought by many in the area the use of nitrogen and potash is proving just as necessary.

In the northern half of the district—that is, north of Haywards Heath—is the High Weald, where the soil changes again to the very fine, sandy loam of the Tunbridge Wells Sand—a name which many farmers think misleading, because in many ways it behaves as a heavy soil, especially with regard to drainage and necessity for well-timed cultivations. Incidentally, Haywards Heath, which is in the centre of the district and on the main London–Brighton railway, has lately become one of the most important market towns in Sussex, holding a large weekly market and frequent sales of T.T. cattle.

This High Weald area is very heavily wooded and there is the same characteristic amount of hedgerow timber. Indeed, in a bygone age the whole area was one large forest, and names like Forge Wood and Furnace Farm still remain to recall for us the iron smelting industry which was once carried on here, using charcoal from the forest and local ironstone. Nearly all the relatively small farms of the area sell milk, and the cropping is mainly centred round the need for cattle feed. Nearly half the farm land is still in permanent grass, and, indeed, there are many obstacles to ploughing. A number of the fields are very small and often steeply sloping, and, in addition, rabbits are a serious pest. Fortunately, grass can be made to grow well, and can contribute handsomely to dairy cattle requirements as grazing, silage and hay. Over one-fifth of the land is in temporary grass, and it is becoming increasingly recognized that the ley, where conditions permit, can greatly outyield permanent herbage and give a much more profitable response to fertilizers. It is likely, however, that some farms in this area will benefit from the recent extension of the Marginal Assistance Grant to help small livestock farms to become more self-supporting.

The soil of the High Weald can well be termed "hungry", being normally acid and particularly short of phosphate. The potash content is usually low and soon becomes a limiting factor if crops are taken regularly without potash replacement. Many years of continuous arable cropping bring about a serious deterioration in soil structure and a marked lessening of response to fertilizers. Frequent spells in long ley are the only answer.

On the credit side, mid-Sussex has an excellent main-water network, and there are now very few farms without a satisfactory water supply. Rural electrification has reached a high standard, and there is little difficulty in housing sufficient farm workers.

If statistics alone can indicate progress, then they do in the case of this part of Sussex. Since the war, the number of dairy cows has, if anything, increased slightly, but the milk yield per cow has gone up a good deal, and quality in terms of farmers selling T.T. milk has certainly improved. The pig population has just about doubled, while beef cattle have increased by more than 50 per cent. Sheep numbers have crept steadily upwards, despite fencing difficulties and the dog menace near the seaside towns.

W. J. Dalton,
District Advisory Officer

Wise Stock Feeding
11. Feeding the In-Lamb Ewe

The nutrition of the in-lamb ewe, particularly during the last six weeks of pregnancy, has a profound influence on the unborn lamb as well as on its later development. At this time the ewe must be liberally fed

to maintain body weight, even though her previous feeding has been adequate, for the unborn lamb is making increasingly heavy demands on her. Ewes that lose weight, or those that suffer a check during this period, are very prone to twin disease (pregnancy toxaemia), irrespective of their previous level of feeding.

For the first month the young lamb is almost entirely dependent on its mother's milk, and the quantity it gets has a marked effect on its growth rate —and even on its survival when the weather is bad. The aim should therefore be to get the ewes in rising condition at lambing time so that they produce strong lambs, have a good milk supply, and run a minimum risk of pregnancy toxaemia. This can be achieved only by an improving level of feeding as lambing time approaches and by avoiding a check during the critical last six weeks of pregnancy.

Even for this brief discussion on feeding, it is necessary to divide sheep into the main categories of hill, lowland grass, and arable land flocks.

Very little can be said about the feeding of hill sheep, but good management by an experienced shepherd is of paramount importance. Hill sheep are generally not brought down to lower enclosed land, except during the most severe weather, and no hand feeding is given, apart for a little hay when the ground is covered with frozen snow. The hill ewe during its critical late pregnancy period has therefore to rely mainly on herbage which is not only scarce but at its lowest feeding value. This scarcity of food could be overcome by suitable management of the lower enclosed grassland. Wherever possible, the flock should be rotated over several small areas of grassland. In this way, the sheep get a sequence of fresh herbage whilst, at the same time, other areas are rested. But naturally this system of management calls for good fencing. A field, consisting possibly of a young ley (preferably first-year "seeds", or a specially-sown catch crop, such as Italian ryegrass or a mixture of winter rye and Italian ryegrass), should be set aside for the production of early grass for the ewes after lambing. The rye-ryegrass mixture has much to commend it. Properly prepared foggage from grass put up about the end of August and suitably manured can also help materially in providing a good supply of food before the early spring grass becomes available.

The management of grassland flocks varies as between upland farms and the real lowland, but again the same general principles apply. The flock should be moved regularly, and early spring keep should be provided. Management can be much more flexible by resting suitable fields of young leys and by the timely application of nitrogenous fertilizers for early bite.

During periods of scarcity the grass keep can be supplemented in a number of ways. A common practice on some upland farms is to grow a small acreage of turnips and swedes for folding off with ewes and lambs during March and April. These can be useful supplements, but some measure of control by an on-and-off system of feeding should be adopted to guard against the breeding stock eating too much.

On lowland grassland farms up to ½ lb. a day of leafy, well-cured hay should be fed as the supply of grass becomes limited. During the four weeks prior to lambing, about 1 lb. of a mixed cereal and protein concentrate should be fed in addition to the hay. A suitable mixture would be equal parts by weight of oats and linseed-cake meal. Alternatively, where good quality grass silage has been made, a daily ration of 5 lb. silage plus 1½ lb. oats would be a useful supplement to the limited amount of grazing. On mainly arable farms, where turnips or swedes are available, a daily ration during

this period could be: 10 lb. turnips or swedes, ½–1 lb. hay, and 1 lb. oats and linseed-cake meal (equal parts).

A generous level of feeding just before lambing has the effect of "steaming up" the ewes for milk production. After lambing, their demand for digestible food increases, and feeding must be directed towards the production of milk. Grass is the ideal way of providing this food, but on mainly arable farms other succulent foods, such as mangolds, swedes or kale, will replace it. The following daily rations are suitable for a 160 lb. ewe:

		lb.				*lb.*
(a)	Kale	20	*or*	(b)	Swedes	23
	Clover hay ..	1½			Clover hay ..	1½
	Mixed concentrates	1½			Mixed concentrates	1½

The type of concentrate used is largely a matter of choice, but it can be of similar composition to that fed to dairy cows for milk production. For example, a suitable mixture would be 1 part by weight of decorticated groundnut meal, 1 part flaked maize and 3 parts crushed barley. Ewes rearing twin lambs should have their concentrate allowance increased to 2 lb. daily. Water, salt and mineral licks should always be available.

How the foregoing suggestions are implemented will depend on the system of farming practised. The important principle, however, on any type of farm is to provide good quality keep, both in the final stages of pregnancy and during suckling. This should ensure that the ewes produce strong lambs and the milk necessary to give them a good start.

J. R. Lloyd

Poultry Stock Improvement Plan The issue last month of the county lists of members of the Poultry Stock Improvement Plan may prompt many readers to ask about the value of such schemes and how effective they are in improving the country's flocks. A precise answer is not easy to give, but one example may be quoted which may give a guide to the importance of the Plan to the poultry industry. Since 1939 the proportion of eggs in the 2 oz. and upward ranges produced by the nation's flocks has steadily increased, although until last year (1953) there was no incentive to the poultry keeper to produce larger eggs, and in any case egg weight is a characteristic controlled by breeding. Moreover, egg weight is a highly heritable characteristic; that is, it is rapidly influenced by selective breeding. Now the P.S.I.P. member must not incubate or sell hatching eggs below a certain weight, and clearly this action has tended to "fix" good-sized eggs in his flock. As the membership of the Plan rose rapidly during the war and immediately afterwards, the effect of fixing this factor in the flocks owned by members would be increasingly passed on to their customers through chick sales. This seems the only explanation of the change in the proportion of larger eggs over the last ten years, and it indicates how the P.S.I.P. can influence the character of our national flock.

Other factors of importance to the commercial poultry-keeper, such as high egg numbers and low mortality, are not so quickly improved. It is, therefore, all the more important that the commercial egg producer should pay greater attention to ensuring that he buys his laying stock from flocks possessing these factors. Breeders in the P.S.I.P. must have flocks with sound production levels and reasonable freedom from disease. Moreover, the conditions with which their flocks must comply are continually being extended and up-graded, and it seems clear that the wisest policy for the commercial table egg producer is always to buy from a member of the Poultry Stock Improvement Plan.

R. Coles

The Swine Fever—Registered Vaccinated Herds Scheme The new Swine Fever—Registered Vaccinated Herds Scheme is open to all pig-breeders; that is, to those whose purchases of pigs are confined mainly to breeding stock. To participate, a breeder is first required to sign an undertaking with his veterinary surgeon that he will have all his pigs vaccinated—his breeding stock at least once a year—and to declare that he will not sell any unvaccinated pigs, except (a) those under four weeks old, sold with their vaccinated dam, or (b) purchased pigs sold for slaughter during their isolation period.*

The breeder is required to keep an up-to-date record of his herd on a form supplied by the Ministry of Agriculture. The form also provides for the date of vaccination to be recorded and for the signature of the veterinary surgeon to show that the pigs included in the record have, in fact, been vaccinated.

Standard fees charged by veterinary surgeons under the scheme are as follows:

	s.	*d.*	
Turn-out fee	7	6	
Vaccination fee (first 24 pigs)	2	0	per pig
Vaccination fee (remainder)	1	6	per pig
Vaccine 10 c.c. (for a large pig) ..	4	6	
Vaccine 5 c.c. (for a small pig) ..	2	3	

Thus, to vaccinate a herd of, say, 10 large pigs and 40 small pigs, would cost £11 9s. 6d., an average of approximately 4s. 7d. per pig.

A limited number of pig-breeders are at present supplied by their veterinary surgeons with the vaccine to enable them to carry out the vaccination themselves under general veterinary advice. These particular breeders are being allowed to continue this arrangement within the scheme, but the facility is not being extended to other breeders.

When the signed undertaking is sent to the local office of the Ministry's Animal Health Division, particulars are entered in a register and a number is allotted. A copy of the undertaking is then sent to the breeder and, at the same time, he is informed of his registered number. He is then entitled to describe his stock as a registered vaccinated herd. The advantages of owning a registered vaccinated herd will become more apparent as more breeders come into the scheme, but it is reasonable to suppose that there will be a greater demand for pigs that come from vaccinated herds than for those which are susceptible to swine fever.

Full particulars of the scheme may be obtained from any veterinary surgeon or from the local office of the Animal Health Division of the Ministry of Agriculture.

This Mild Winter Up to the time of writing (mid-December) this, I think, has been the mildest winter I have ever known. Here in South Devon, as I imagine is the case in other parts, the local people have one of two observations to offer: either "we shall pay for it later on", or "it will shorten the winter." I cannot see that either of these dicta is necessarily true, but it may well be that, by the time these lines appear in print, our unpredictable English weather will have made them read strangely. In my less sanguine moments I confess to an uneasy recollection that the November of the grievously bitter winter of 1946-47 was just such a month as the one just passed. However, we shall see.

*Any unvaccinated pigs purchased must be isolated for 28 days and vaccinated during this period.

FARMING AFFAIRS

As usual, on all sides one hears the prophecy that the heavy crop of wild berries presages a hard winter. For myself, I cannot see how the condition of any crop at any season of the year can have any possible bearing on the weather that is yet to come. I think the most that a heavy berry crop can show is that the weather of the year, so far, has been favourable to the growth of berries !

With the effects of this mild winter on farming affairs I have no immediate concern. I believe that they have been considerable, but not, I think, wholly bad. Certainly on wild life generally they have been quite remarkable. Today, December 15th, on a nearby common I have seen in flower gorse, daisy, bladder campion, dog violet and others. In the village gardens, as well as the seasonable chrysanthemums there are roses, azaleas, antirrhinums, marigolds, primroses and aubretia in full bloom. Against my own garden wall a Forsythea flowers untimely.

In the wood beyond there are many hazel catkins and one male sallow in bloom. Around the sallow bluebottles and hover-flies are to be seen, and on the 13th, when it was warm and sunny, there were even honey-bees. On the same day I saw a male brimstone butterfly, lured out of hibernation by the sunshine. On the upper landing of my house there are three hibernating small tortoiseshells. As a rule these butterflies, when once they have taken up their winter quarters, move little or not at all from the positions first chosen for their rest. But for a month past these three tortoiseshells of mine have been shifting their positions almost daily, and any morning now, if the fine mild weather holds, I expect to discover one or more of them missing.

Often in the evening there are bats in flight; most of them pipistrelles, with a noctule now and then. Last night a pipistrelle was hawking for winter-moths around the street lamps in the village, and doing not so badly, either.

In some of the buries in the hedge banks there are litters of young rabbits. Only yesterday I saw one furry atom, hardly bigger than a cricket ball. Also there are hedgehogs still out and about, and a dormouse has been reported to me as being on the move. This last is hard to credit, but my informant is reliable. At my favourite badger's sett the old pair are working away after dark like steam engines, dragging our great loads of earth and debris. Clearly they are making the most of this fine house-cleaning weather.

Some of the birds seem not to know what to make of it. The companies of golden plover move from moor to farmland and back again, as if uncertain where to stay. Whether the weather has any bearing on the matter I do not know, but this winter the companies are bigger than any I have seen for many years. In the wood a solitary male blackcap lingers on. Blackcaps have wintered in the county in other years, but, all the same, a blackcap anywhere in England in December is something to write about. Three days ago I saw a hen blackbird with some dry grass in her bill. In most mild winters there are a few of these deluded early builders, most of them doomed to lose their first broods.

In the rivers there is less water than I remember in December, despite the fair amount of rain that we have had. Today, my favourite trout stream is down to summer level and clear as crystal. And only a week ago I walked from Burrator to Coombeshead without getting my feet wet. That, too, is noteworthy for December.

Foremost among the beneficiaries in this mild spell are the Dartmoor ponies and the black-faced moorland sheep, which must have been having

an easier winter than they have known for many years. Normally at this season the village roads and lanes are full of the ponies, which in hard weather come in for better feed than they can find on the Moor itself. So far, only a few small bands of stragglers have turned up here.

Its "unseasonable" nature notwithstanding, I think that both man and beast in general are grateful for the pleasant break. I, as a layman, of course speak for myself. Some of my farming neighbours mutter to themselves and make dark prophecies about it, although I suspect that even they enjoy it when they can forget their crops and stock. It may be, as they say, that we shall all pay for it later on. Meanwhile, I rejoice in present good, and hope that, in the event, the worst of their forebodings may not prove justified.

F. Howard Lancum

BOOK REVIEWS

The Fruit Year Book, 1954. Royal Horticultural Society. 10s.

The Thirteenth International Horticultural Congress produced many papers of interest to fruit growers, and it is fitting that three of the most outstanding ones should be in the R.H.S. *Fruit Year Book*. The three chosen were M.B. Crane on fruit breeding, J. M. S. Potter on new varieties of fruit in this country, and that by Dr. W. A. Ross calling attention to the need for modifying orchard spray programmes to supplement the work of, instead of to destroy, pest predators.

But, the book is by no means confined to material which has already been published elsewhere. J. W. S. Mount writes a stimulating article on the past twenty-five years in fruit growing—the awakening of the industry to research and the developments that have followed—while A. P. Preston gives a welcome review of the new Malling-Merton rootstocks, which are not only resistant to Woolly aphid but offer possible improvements on other well-known Malling apple rootstocks. Frameworking has performed wonders for the bush tree grower, and now E. W. Hobbis describes " perimeter " grafting, with the aid of some splendid photographs, as a quick turn-round method of renovating big orchard trees and vintage cider varieties. R. J. Garner, pre-eminently practical, shows how double-working can be simply done in one operation to solve the problem of weak unions and unthriftiness in pears on quince stock. Dr. C. Bould reviews the ever-increasing range of mineral deficiency problems in the orchard, and gives practical directions for remedial spraying.

The amateur is catered for in N. L. Harris's adventure in Gallic formalism with the Lepage arched cordon system, E. G. Gilbert's layout of a model fruit garden for areas large and small, based on the Wisley model, and, lastly, he can draw upon Miss B. A. Crang's unique knowledge of the home preservation of fruit.

This particular issue is dedicated to Norman Grubb, of whom there is a very characteristic portrait. What should most be noted is the Society's act of faith in reducing the price of the Year Book. It is very good value for money. May increased sales justify—and perpetuate—the gesture.

R.T.P.

The History of the Women's Institute Movement in England and Wales. INEZ JENKINS. Oxford University Press. 10s.

As one of the early secretaries of the National Federation, Mrs. Jenkins is well qualified to write this history, since her own memories of the Women's Institute go back as far as 1919, when the movement was only four years old.

The first six chapters of the book are concerned with chronological history and are perhaps the most interesting, recording, as they do, the efforts of several pioneers to start Women's Institutes in this country ; the founding, in September 1915, of the first Institute in that famous Anglesey village with the long name, usually referred to as Llanfair P.G., and the amusing descriptions of the early days and growing pains.

There follow chapters on the activities which the movement has particularly made its own—craftwork, growing and marketing produce, music and drama, and international relations. " The Lighter Side " contains many anecdotes which it is good to see recorded

so that they will not be lost ; some may, at first glance, seem improbable, but certainly not to anyone familiar with the delightful individuality of W.I.s.

The last chapter, " To-day and To-morrow," brings the story up to date, with the 7,611 Institutes in a vastly changed and still changing countryside, and sets out some ideas for the future aims of the movement.

There are some excellent photographs of the first three Chairmen of the movement and of three Queens who have all been members of Sandringham W.I., as well as a number showing the activities of the " ordinary members."

As so many people in the movement are mentioned personally—in government departments and elsewhere—it is regrettable that there is no reference to Miss E. H. Pratt who, in the Ministry of Agriculture, fought the W.I. battles for twenty-five years and was so well known to generations of members. I missed, too, the name of Miss Elizabeth Hess, the first Produce Guild Organizer and later Agricultural Secretary. The origin of the Fruit Preservation Scheme is not given correctly ; it was in fact, prepared in detail within the Ministry of Agriculture before the war began. There is also no mention of the starting of Produce Guild tests after the war. These, however, are small criticisms to make of a book which catches so well the spirit of the W.I. movement.

M.M.

Farmer and Stock-Breeder Year Book, 1954. 10s. 6d.

Ideally, this is something that should have been found in the Christmas stocking; for a more acceptable gift to anyone concerned in any way with the agricultural industry – whether man-in-the-field or man-in-the-office – it would be difficult to find. The clearly delineated and well-indexed reference section of some 150 pages presents much useful information about addresses and principal personnel of official bodies, farmers' organizations, research and educational institutions; A.I. centres; stock-feeding; weather information; notes on income tax and vehicle licensing laws; tractor specifications; and weights and measures, to pick out just a few of the items. The section on British Farming Records will be invaluable for settling arguments in the local and dissipating self-satisfaction on the farm. Do you know what was the highest price paid for a bull of any breed, the highest milk yield in a single lactation, or which variety of wheat holds the record yield? The answers are all here.

There is also the usual excellent photogravure section of 62 pages, illustrating the champion show stock of the year – impressive evidence of modern livestock improvement. And to brim the cup, ten special articles explore the economics of present-day farming, beef production on silage, grass leys, quality barley, sheep, pigs, machinery, artificial insemination, and Johnes's disease. In a separate section on poultry, two more articles discuss genetical improvement by hybridization, and the housewives' market choice.

In short, this is a book which may well be the answer to many a half-guinea book token.

S.R.O'H.

The Farm Workshop. H. J. HINE. Crosby Lockwood. 15s.

Keeping mechanical equipment in good order is as important to farmers as choosing a good set of equipment and knowing the best methods of using it. Most farmers have in recent years spent large sums on their equipment and have thereby managed to keep on top of their work and, at the same time, to keep labour costs at a reasonable level; but many are finding that repair and maintenance of the equipment is unexpectedly expensive. Mr. Hine's book is written to show how the installation and operation of a sensibly planned farm workshop can help in keeping equipment going in an economical manner.

Naturally, the scope of the work to be done in a farm workshop must depend on the size and nature of the farm, and the author begins by suggesting what kind of a shop is needed for the main sizes and types of farm. For the smallest farms a few hand tools may suffice, while a large, mechanized farm can usefully employ a full-time mechanic and a limited range of power-operated tools.

Subjects discussed include the workshop building itself and choice and use of hand and power tools, with many useful hints on workshop practice, carpentry, blacksmithing and welding. An indication is given of the range of jobs that can be effectively and economically tackled in a wide range of conditions, and emphasis is laid on the need to make the choice of equipment and the scope of the work suit both the farm and the men who will work in the shop.

The 142 illustrations of workshops and equipment assist in making this book a useful and attractive guide, and there can be no doubt that many farmers who are considering starting or expanding a workshop will find here much of the information they need.

C.C.

The Changing Wild Life of Britain. H. L. EDLIN. Batsford. 21s.

The main object of this book, it is claimed, is to show the influence of man on the fauna and flora of Britain ; and it may be said at once that in this the author has succeeded. Possibly the most valuable, and certainly one of the most interesting, parts of the book, and the one pointing most morals for modern man, is that on the survival or extinction of carnivorous animals. There are useful lessons here for the serious student.

On the whole, the author has marshalled his facts carefully and reliably, and his arguments are sound, but some of his statements are inaccurate, and others need qualification. Thus he says that in the south of England the stoat remains brown all through the year, in contradistinction to its relatives in Scotland which become more or less white in winter. In fact, a fair number of white stoats are seen in the winter in the south of England, and I myself have found such specimens in Berkshire, Devon, Essex, and Hampshire. Again, the chough is not yet entirely confined, as stated, " to a few localities in Ireland, Wales and Scotland". There are still choughs in Cornwall. The author is also out-of-date with his information on the breeding status of the avocet in England.

The illustrations are a mixed bag, some being very good and some poor. The captions to some of the illustrations, too, might be looked to in future editions. A woodcut of the great tit is labelled " The Titmouse," one of the barn-owl, " The Yellow Owl," and one of the pine-martin, " The Pine Weasel or Yellow Breasted Marten". It may be that, in days gone by, some of these names were generally applied, but it would surely be better, on all counts, for their accepted modern equivalents also to be given now. Incidentally, in their announcement the publishers refer to " woodcuts, incomparable both for their faithfulness and beauty". One wonders, however, how many people would recognize some of them—particularly that of the wild cat.

A little attention to these and a few other lapses would make this book a useful and acceptable work. Not all the author's views will be endorsed by all naturalists—no naturalist's views ever were—but, for myself, I find much in the book that is admirable, and I would pay a sincere tribute to the author's industry and patience in research. The writing of a book of this kind is no easy task for anybody.

F.H.L.

Efficient Use of Fertilizers. Edited by Vladimir Ignatieff. Food and Agriculture Organisation of the United Nations. Leonard Hill. 10s.

This book has been built up from material supplied by thirty-six agricultural scientists, half of them American and the remainder equally divided between the British Commonwealth and the other countries (excluding the U.S.S.R. group) in which agriculture is well developed. Its purpose is a very wide one, for it is addressed to administrators and advisers in all parts of the world whose duty it is to guide agriculture towards higher output coupled with the improvement and maintenance of soil fertility. For this programme the efficient use of fertilizers, including of course organic manures, is quite essential, but the problem is to recognize other impediments to high production which must be remedied before the full benefit of fertilizers can be secured. Some of these are physical, such as bad water relationships, unfavourable soil reaction, erosion and the like ; others are economic and reside in the poverty or inertia of the cultivators. In any case, it is necessary to develop a coherent system of farming in which fertilizers fall naturally into place.

Covering a field so wide in its variety of soils, crops and climate, the treatment confines itself to matters of basic principles of plant nutrition and fertilizer action. A section on animal manures and vegetable wastes, so important in undeveloped countries, gives much useful information on composting and sewage disposal in many parts of the world. This is followed by a brief survey of the natural sources of fertilizer materials and the main manufacturing processes, including a useful list, not readily available elsewhere, of some sixty fertilizers used in various parts of the world, together with their nutrient content and notes on their composition. Other valuable sections deal with fertilizer placement and the numerous green manuring practices adopted mainly in the tropics.

Finally, there is much information on the organization of field experiments, and the advisory and extension services in many parts of the world. The authors naturally lay great stress on the need for technical information based on field experiments. It should then be tested on pilot farms, and presented in a convincing way to farmers. When all the technical difficulties have been cleared away, farmers must be encouraged to use fertilizers. Subsidies are by no means confined to Great Britain ; arrangements of this kind exist in most other countries, and the book provides some interesting details on this point.

For readers primarily concerned with English farming, this F.A.O. monograph gives a wider view of fertilizer problems than our relatively settled system provides. It seems a pity that so useful a book has been given only a thin paper cover.

H.V.G.

BOOK REVIEWS

Just Your Meat. ELWYN JONES. National Federation of Young Farmers Clubs and the Smithfield Club. 2s. 6d.

Just Your Meat comes at an opportune moment now that an increasing emphasis is being placed on meat production. It will prove a boon not only to Y.F.C. members but also to the older generation, many of whom are now taking up meat production for the first time or after a lapse of many years.

Throughout the book Mr. Elwyn Jones clearly emphasizes that meat-producing animals are valuable only if they produce good quality meat, and that in the right places on the carcass. Further, he has shown that there is a closer co-relationship in beef cattle between the animal on the hoof and the carcass, than there is in dairy cattle between outward conformation and high milk production and butter fat. Wisely, he has confined his remarks to beef cattle in general and avoided detailed reference to any individual breed.

Farmers undoubtedly take in more when the eye as well as the ear is allowed full play—hence the extensive use of photographs to illustrate the author's points in assessing an animal's beef characteristics will undoubtedly prove beneficial. His comparative photographs, indicating good and bad points, show to particular advantage desirable and undesirable features both in the live animal and the carcass. Quantity rather than quality was the rule during the war and in the immediate post-war period, but now, with an ever-increasing tendency to pay on quality, it is essential that meat producers should be trained to recognize those external characteristics indicative of a first-quality carcass.

It is unfortunate that space did not allow Mr. Jones to deal with the production of beef by the use of pure-bred beef sires on low-yielding dairy cows, from which source—for the immediate future at any rate—a considerable proportion of our meat supplies must come. Had he been able to dwell on it, he would undoubtedly have stressed the necessity for keeping such cross-breds progressing from birth if a satisfactory grading is to be obtained at two to three years old.

Although considerable progress has been made in the movement to directly link up pedigree with commercial beef stock, the opposite viewpoint unfortunately still prevails amongst some pedigree breeders. My one criticism of this book is that it rather tends to perpetuate this old idea by giving the impression that there is a difference between an animal bred for pedigree purposes and one intended for the butcher. The end of both is the butcher's block and the consumer. This should always be bourne in mind. High prices paid by overseas buyers for pedigree beef bulls are so paid because they are aware they will recover this financial outlay by the higher prices obtained for the carcasses from the herds in which such bulls or their male progeny are used.

Mr. Elwyn Jones is to be congratulated on the production of such an instructive, concise book covering not only cattle but sheep and pigs as well.

A.J.

Report of the British Council, 1952-53. 2s. 6d.

British Council centres are established in sixty-one countries, and their work, directed towards promoting a wider knowledge of the English language and closer cultural relations between this country and countries overseas, very clearly covers a wide field of cultural, scientific and technical interests.

Many students abroad who wish to study in our universities or take special study courses or tours in this country are enabled to do so with the help of British Council scholarships and bursaries. The Council also nominates British students for scholarships tenable abroad; in this and in many other ways it encourages the conditions of free interchange and co-operation on which the success of its efforts primarily depend.

Agricultural interests appear to be well represented on the Council's programme. For example, students and visitors to the United Kingdom for whom individual arrangements were made in the period covered by the Council's report for 1952-53 included 206 engineers, or engineering students, 115 agriculturists and 439 doctors and medical or nursing students.

Special courses on livestock improvement, field experimentation, the agricultural advisory service, and mineral deficiencies in plants were arranged in the United Kingdom during the year. Lecture tours and advisory visits abroad by British experts included those on soil conservation (Sir H. Glover), mechanized farming (Mr. J. C. Hawkins), grassland improvement (Professor Martin Jones) and agricultural education (Mr. W. B. Mercer).

The Council publishes every two months a well-illustrated journal—*The British Agricultural Bulletin*—which reviews recent advances in agriculture in Britain and the Commonwealth and deserves to be better known to British farmers than it appears to be.

The Council's Science Committee includes an agricultural panel headed by Sir James Scott Watson, and a veterinary panel of which the Ministry's Chief Veterinary Officer is Chairman.

A.J.L.L.

Farm Mechanization Directory 1954. Temple Press. 21s.

As each new year comes round, I am overwhelmed afresh by the thought of the monumental patience and industry possessed by that anonymous band of compilers of directories, year books and the like. Not that the appearance of these annuals is ever greeted with acclaim in literary circles; they are accepted as a kind of natural phenomena, like the falling of the leaves in autumn or the recording of the first cuckoo in spring. But how difficult it is to get along without them!

The *Farm Mechanization Directory* is a comparative infant in the world of reference books, but it is already firmly established and treasured wherever farm machinery is kept, sold or merely talked about. The 1954 edition has been enlarged and remodelled, with a much more durable binding and a new finger-tip index to allow of easy reference to its component sections. It stands as a comprehensive guide to the whole range of British-made agricultural and horticultural machinery and comparable foreign equipment marketed in the United Kingdom. In addition to some useful information on the many organizations interested in machinery, it will yield, so the editor tells us, the addresses and trade marks of over 1,800 manufacturers ministering to the needs of the industry—a fact that demonstrates the tremendous influence modern agriculture exerts in the engineering world.

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L.W.T.

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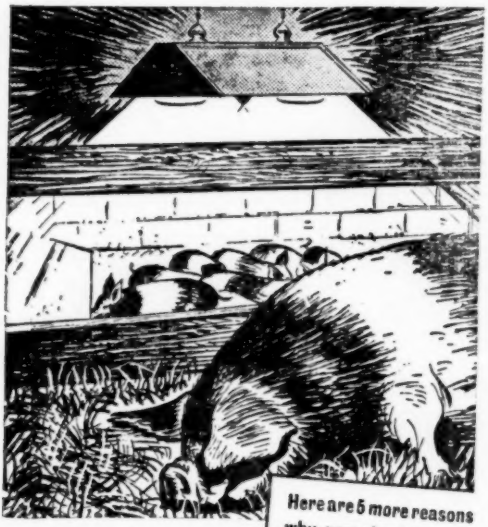

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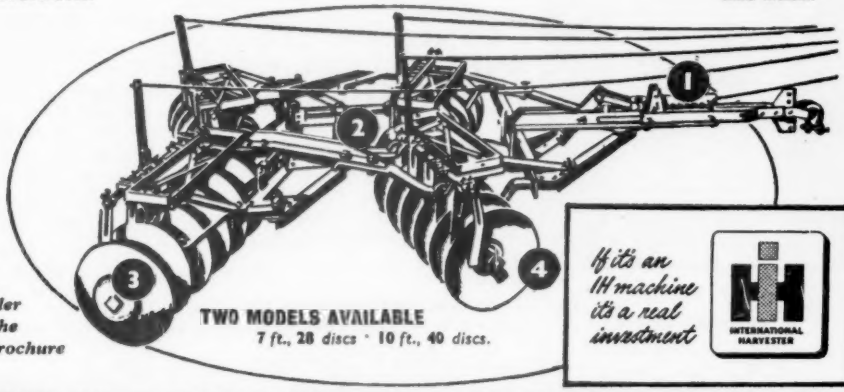

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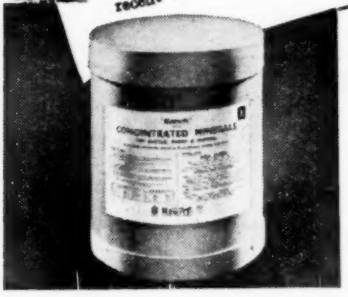

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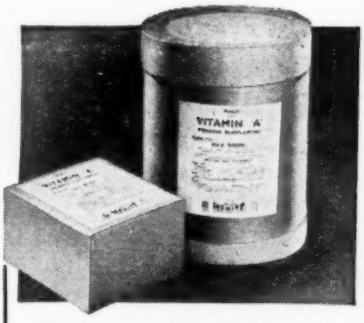

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Winter on the Farm

The work on the farm in January depends very much upon the weather.

In any case, there are two tasks which, if not done previously, are most suitable for January. The first is to order all the fertilizers required for the coming season and to obtain delivery of those needed for the early bite of grass and the top-dressing of cereals, and the second is to see that the fertilizer distributor is in perfect working order. Although this machine may have been washed down and oiled when put away in the autumn, it would certainly be a useful job for one of these short January days just to turn over the mechanism and to see that none of the tubes has perished.

Silage

When calculating the amount of silage required to see the stock through until the early bite of grass is available, the figure of 4 tons for each cow equivalent in the herd is a good average to work on. The winter period used to be regarded as 200 days, but if three weeks indoor feeding can be saved at both ends of the winter by a spring early bite of grass and by late autumn grazing, the winter period can be calculated as 150 to 160 days.

Fertilizers

Many farmers are getting an extra-early bite by sowing a field to Italian Ryegrass and top-dressing it with not less than 3 cwt. Sulphate of Ammonia or 4 cwt. 'Nitro-Chalk' per acre.

To seize the opportunity of weather and soil condition so that nitrogenous fertilizers may be applied as early as possible, has become a major factor in modern farming practice.

A matter of Trucks & Lorries

EVERY YEAR, the seasonal work on the farm begins a little sooner.

For instance, grass can now begin to give a full bite any time from mid-March to mid-April instead of some time in May—provided that 3 cwt. of Sulphate of Ammonia or 4 cwt. of 'Nitro-Chalk' are applied per acre in February.

Why not take your Sulphate of Ammonia in *January* this year—while the flow of railway trucks and merchants' lorries remains smooth and unbroken.

There is a bigger price rebate in January.

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

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